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THE IRON AGE

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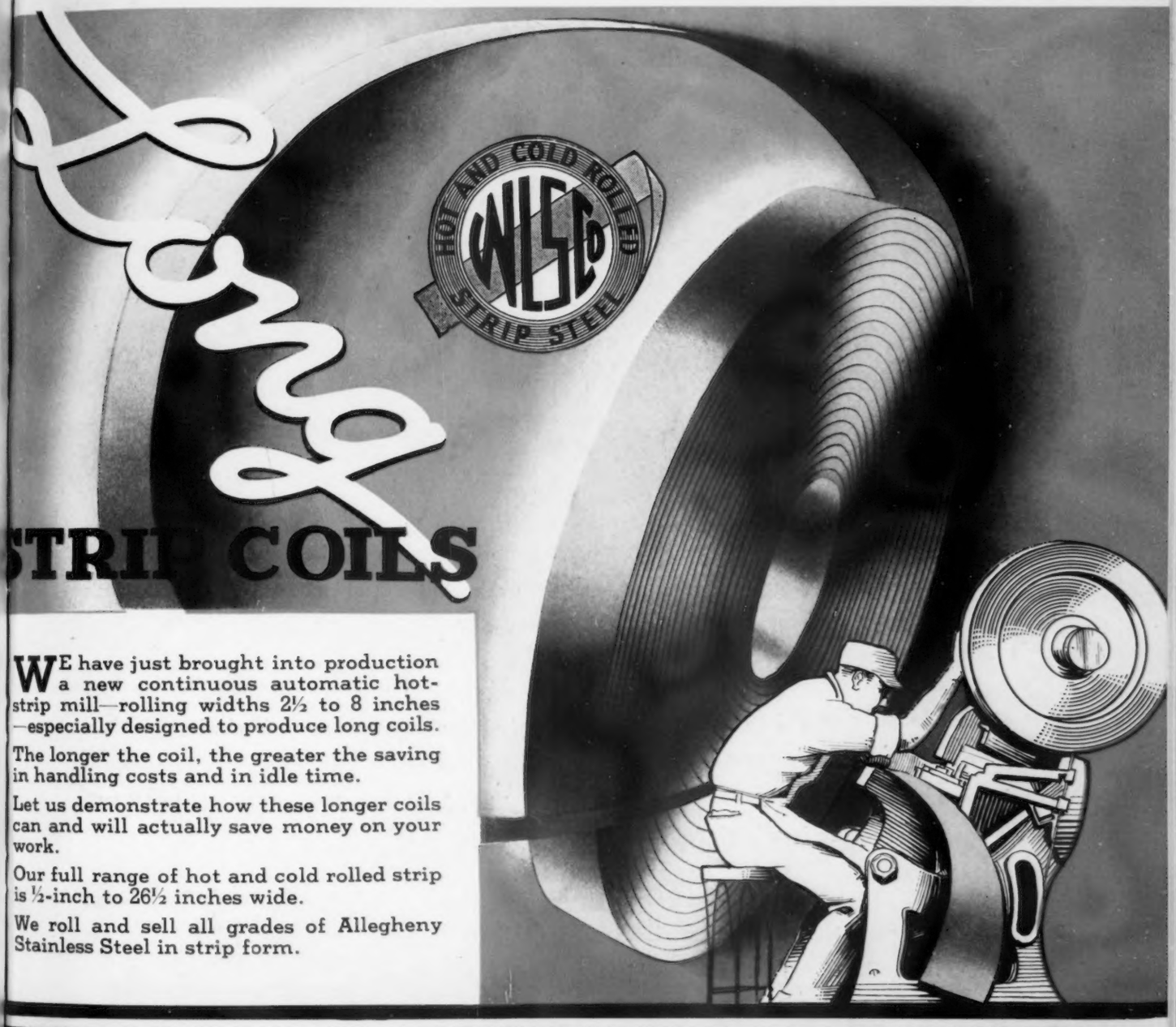

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Executive and Publication Offices.
Chestnut and 56th Sts., Philadelphia, Pa.

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Member, Audit Bureau of Circulations

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Published every Thursday. Subscription Price: United States and Possessions, Mexico, Cuba, $6.00; Canada, $8.50, including duty; Foreign $12.00 a year. Single copy, 25 cents.

Cable Address, "Ironage, N. Y."

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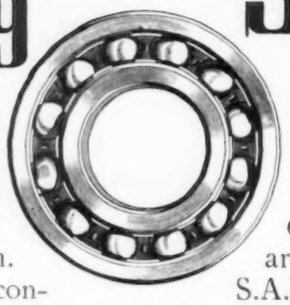
SOME NOTES ON BETHLEHEM ALLOY STEELS

Bearing Steels



THE bearing industry demands a high degree of cleanliness in race, ball and roller steel, and carefully controlled practices are therefore necessary at every stage of production. The Bethlehem plan of metallurgical control as applied to bearing steels not only assures exceptional cleanliness but the accurate control of physical characteristics that is essential to economical machining and to facilitate control of hardening operations.

The ball- and roller-bearing industry absorbs a large tonnage of steels of this highly-refined type for races, rollers and balls. The steel most commonly used for races is S.A.E. 52100, where great load- and wear-resistance are required. Where a tough interior and hard surface are necessary because of shock, carburizing steels such as S.A.E. 4615, 5120, 3115, 3312 and 6120 are used. Other types of bearings are manufactured from such steels as S.A.E. 4150, 6195 and manganese-chromium, nickel-chromium-molybdenum, etc.

Balls are generally made from a high-carbon, high-chromium steel, the carbon content being about the same as that of S.A.E. 52100, but the chromium percentage is lower. In some cases, this steel has from 0.20 to 0.30 per cent of molybdenum added.

Bar stock for automatic machining of races and for cold-heading of balls is usually specified annealed to a spheroidized structure. Bars for forging are specified "as rolled."

TABLE OF CHEMICAL COMPOSITIONS FOR STEELS FOR BEARINGS

		52100	*Mn.-Cr.*	*5120*	*4615*
Carbon	%	0.95 to 1.10	0.85 to 1.00	0.15 to 0.25	0.10 to 0.20
Manganese	%	0.20 to 0.50	1.00 to 1.30	0.30 to 0.60	0.40 to 0.70
Phos. (max.)	%	0.03	0.03	0.04	0.04
Sul. (max.)	%	0.035	0.035	0.05	0.05
Silicon	%	0.15 to 0.30	0.20 to 0.40	0.15 to 0.30	0.15 to 0.30
Nickel	%	....	....	....	1.65 to 2.00
Chromium	%	1.20 to 1.50	0.30 to 0.50	0.60 to 0.90	....
Molybdenum	%	....	....	....	0.20 to 0.30
		4150	*3115*	*6120*	*6195*
Carbon	%	0.45 to 0.55	0.10 to 0.20	0.15 to 0.25	0.90 to 1.05
Manganese	%	0.60 to 0.90	0.30 to 0.60	0.30 to 0.60	0.20 to 0.45
Phos. (max.)	%	0.04	0.04	0.04	0.03
Sul. (max.)	%	0.05	0.05	0.05	0.035
Silicon	%	0.15 to 0.30	0.15 to 0.30	0.15 to 0.30	0.15 to 0.30
Nickel	%	....	1.00 to 1.50	....	....
Chromium	%	0.80 to 1.10	0.45 to 0.75	0.80 to 1.10	0.80 to 1.10
Molybdenum	%	0.15 to 0.25	....	....	....
Vanadium	%	....	....	0.15 min.	0.15 min.

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... THE IRON AGE ...

FEBRUARY 27, 1936

ESTABLISHED 1855

Vol. 137, No. 9

A Message From the New President of the American Institute of Mining and Metallurgical Engineers

JOHN MESTON LOVEJOY, president of the Seaboard Oil Co., elected president for 1936 of the American Institute of Mining and Metallurgical Engineers.

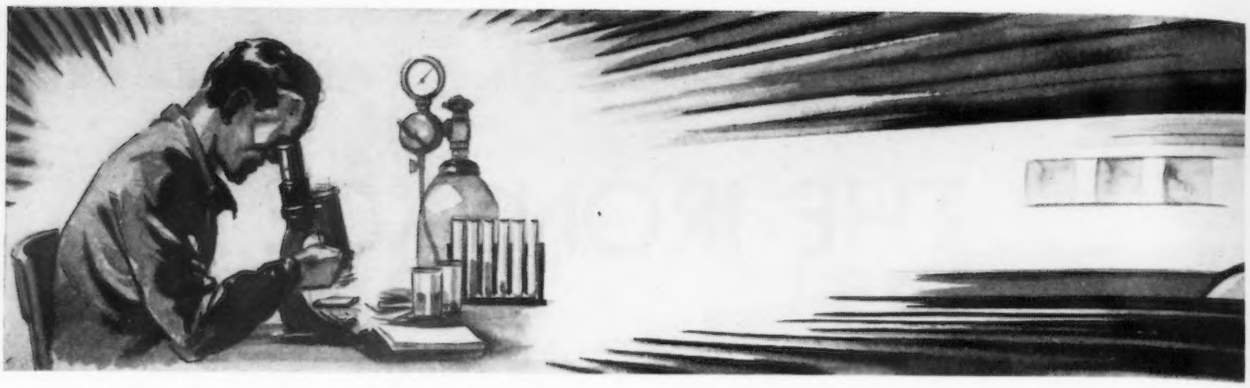
o o o

FOR 65 years the American Institute of Mining and Metallurgical Engineers has had before it a two-fold purpose: to promote the professional interests of engineers and to promote the welfare of the mineral industries in which they are engaged.

Of the various fields that it covers, none is more important today than development of the arts of producing metals and alloys that will meet the exacting requirements of modern industry. This progress is based on the achievements of engineers in the research laboratory and the plant. But for the metallurgist and metallurgical engineer, a dozen major industries would be far behind the position they have attained today.

The Institute will continue the dissemination of technical knowledge among engineers through its meetings and its publications in its efforts to promote the interests of our profession.

John M. Lovejoy



175 Technical Papers Presented

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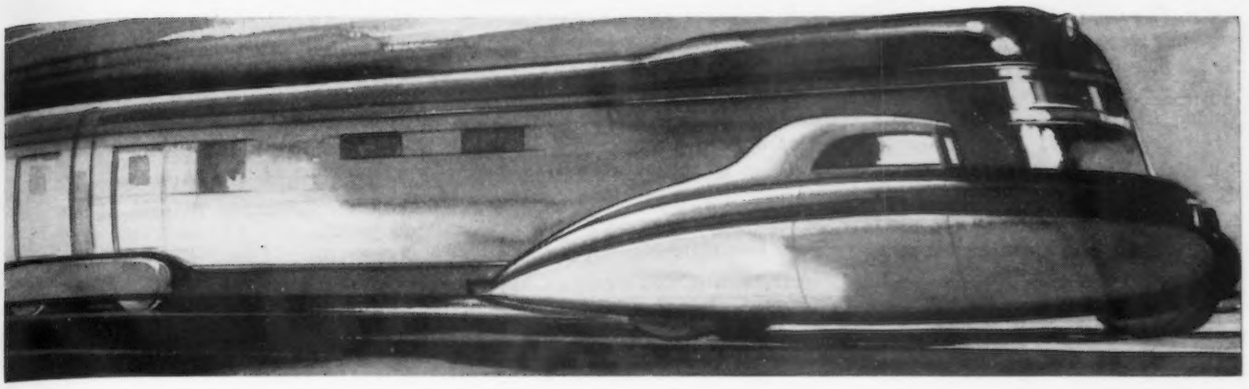
FOR the one hundred forty-fifth time the American Institute of Mining and Metallurgical Engineers has met in formal session, and executives of the Institute in the Engincers Society Building in New York City are willing to testify that last week's congress was the most successful in history. Approximately 1700 members attended the various technical sessions. This registration is approximately 10 per cent greater than in 1935 and about 20 per cent greater than the attendance in 1930. Approximately 175 technical papers were presented during the four-day session, and these papers covered a range of technical information including mineral economics, rare metals and minerals, theoretical and physical metallurgy, metals in transportation, mining and milling methods and health and safety in mines. Of considerable importance also were the reports presented on Monday, Tuesday and Wednesday dealing with the mining, concentration and more efficient combustion of coal.

One of the most interesting events of the entire meeting was an all-day excursion on Friday to the General Electric Co. plant at Schenectady. About 300 members of the A.I.M.E. took advantage of this opportunity to examine one of the world's most interesting and varied industrial plants in operation. Naturally enough the General Electric Co. featured its prize exhibit, the "House of Magic," but of equal interest was the inspection tour through buildings wherein refrigerator units were being assembled, and the department devoted to assembling the large waterwheel generators for the Wheeler and Bonneville Dams. Visitors were also demonstrated the practicability of X-raying thick sections of metals, and were given an opportunity of examining stereoscopic views in order to perceive flaws within thick and complicated sections of steel. The guests then toured the Porcelain Products Division, which contains a continuous kiln, said to be the longest in existence and capable of maintaining a better temperature control than any other direct-fired unit ever built. This department is equipped to manufacture products varying from giant insulators to switch parts but a fraction of an inch long. Also of considerable interest to the visitors was an outdoor mercury steam and electric generating plant, built by the General Electric Co. and leased and operated by the New York Power & Light Corpn. The mercury and steam cycle which is used is the most modern and efficient form of generating power. This installation is outstanding in



Before 145th A.I.M.E. Congress

many respects, inasmuch as it is an "outdoor" installation and succeeds in coordinating utility electric and industrial steam demand very profitably.

As usual the A.I.M.E. had arrangements for a cruise to Bermuda. About 28 members took advantage of this opportunity and sailed on the Queen of Bermuda last Thursday and are scheduled to return to New York this Friday.

Four Awards Announced

Naturally enough the high point of the week's meeting was the annual dinner, reception and dance on Wednesday evening at the Commodore Hotel, New York. At this dinner, Clinton H. Crane was awarded the William Lawrence Saunders medal, a certificate of honorary membership was presented to Robert Peele, the Robert W. Hunt prize for 1936 was awarded to C. C. Henning, and the J. E. Johnson, Jr., award was presented to Francis Hearne Crockard.

Mr. Crane, the recipient of the Saunders medal, is president of the St. Joseph Lead Co., largest producer of lead and one of the largest producers of zinc in the United States. He is a graduate of Harvard University and took post-graduate work at the University of Glasgow. He has been at the head of the lead company for 20 years. The citation accompanying the award states that it was given "for distinguished achievement in the successful development and operation of low-grade lead mines." The St. Joseph Lead Co. obtains the bulk of its lead production from mines in southeast Missouri, where the ore contains an average of about 75 lb. in lead to the ton whereas most of the other mines in the country recover from 120 to 200 lb. of lead to the ton, plus by-product silver which is not found in St. Joseph ore.

Among other recipients of the Saunders medal have been Herbert Hoover and John Hays Hammond. Last year's award was to James MacNaughton of Calumet, Mich.

C. C. Henning, recipient of the Robert W. Hunt prize for 1936, was awarded that distinction for his paper, "Manufacture and Properties of Bessemer Steel," which was presented at the February, 1935, meeting of the Institute. The prize is given to the person or persons contributing the best original paper on iron and steel and is made from a fund established by the partners and employees of Robert W. Hunt in honor of his contributions to the steel industry. Mr. Henning is assistant general metallurgist of the Jones & Laughlin Steel Co., Pittsburgh, Pa.

Francis Hearne Crockard, recipient of the tenth J. E. Johnson, Jr., Award, is a metallurgist with the Republic Steel Corpn. at Thomaston, Ala. The award is made annually to persons, not over 40 years of age, who have made a meritorious contribution to the metallurgy of iron and steel, from a fund established in the memory of J. E. Johnson, Jr., a well-known authority on iron blast-furnace construction.

The new honorary member, Pro-

fessor Peele, has been a member of the Institute since 1883, joining it 12 years after its formation. He is professor emeritus of mining in the School of Mines at Columbia University and is the author of "Peele's Mining Handbook," which is an established reference book in the mining industry. The Institute has only 16 honorary members. Professor Peele was introduced at the annual dinner by Nicholas Murray Butler, president of Columbia University.

Lovejoy New President

At the annual business meeting of the Institute, which was held last Wednesday, it was announced that John M. Lovejoy, president of the Seaboard Oil Co., would function as president of the American Institute of Mining and Metallurgical Engineers for the year ending February, 1937. Mr. Lovejoy succeeds Henry A. Buehler, state geologist and director of the Missouri Bureau of Geology and Mines, as head of the Institute, which is composed of 9000 engineers and executives of the mineral industries.

Mr. Lovejoy has been a member of the Institute since 1916. He graduated from the Columbia School of Mines in 1911 and began his professional experience on the engineering staff of the Chile Copper Co. at Chuquicamata, Chile, South America. In 1914 he became a geologist for the Standard Oil Co. in China, later working in Wyoming. He joined the U. S. Army at the outset of the World War and served as a captain of field artillery. After the war and on his return to the United States he became a geologist for the Amerada Petroleum Co., eventually becoming vice-president of the company with offices at Tulsa, Okla. More recently he has been in New York, first as president of the Petroleum Bond & Share Co. and then in his present capacity as head of Seaboard Oil.

In addition to announcing Mr. Lovejoy as 1936 president, the Institute directors elected Roland C. Allen and Wilfred Sykes, vice-presidents of the Institute, and re-elected Henry Krumb as vice-president. The six directors who were chosen, several of them for second terms, include Eli T. Conner, coal mining engineer, of Scranton, Pa.; John L. Christie, metallurgist, of Bridgeport, Conn.; Selwyn G. Blaylock, vice-president of the Consolidated Mining & Smelting Co., of Trail, British Columbia, Canada; Frank L. Sizer, mining engineer, of San Francisco, Calif.; Erskine Ramsey, Birmingham, Ala., and William B. Heroy, oil geologist, of New York City. Mr. Heroy is president of the American Petroleum Institute.

Mr. Allen, who becomes a vice-president for the first time, is a resident of Cleveland. He was born in Indiana and graduated from the University of Wisconsin in 1902. His early professional experience was teaching geology. He became State Geologist of Michigan in 1909 and served in that post for 11 years. Since then he has been associated with the Oglebay, Norton & Co., one of the large producers of iron ore in the Lake Superior area, serving for a large part of the time as executive vice-president and manager of mines.

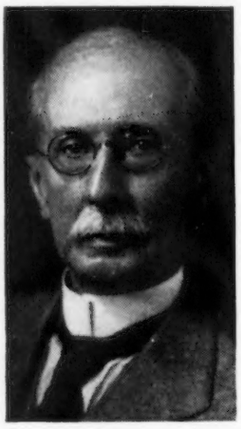
Mr. Sykes, also a new vice-president, succeeded John M. Lovejoy, who was elected president. Mr. Sykes is assistant to the president of Inland Steel Co. and has been a member of the Institute since 1915.

Mr. Krumb, who has offices in Salt Lake City, Los Angeles, and New York, has been a vice-president of the Institute since 1928. He is a graduate of the Columbia School of Mines and has for many years been prominent in the development of many of the largest non-ferrous metal mines on the North American continent. In his association with the Guggenheim Exploration Co. he was particularly closely connected with the discovery and exploitation of the low-grade copper porphyry mines of Utah, Nevada and Arizona. Mr. Krumb is now a director of the Newmont Mining Co. and Mayflower Associates.

CLINTON H. CRANE, awarded the William Lawrence Saunders Medal for "distinquished achievement in the successful development and operation of low-grade lead mines."

Special Lectures Given

Historically the most important technical lecture of the entire meeting is the Henry Marion Howe memorial lecture. This year H. F. Moore, research professor of engineering materials of the University of Illinois was the recipient of this honor. His address, which was the thirteenth Howe lecture, was devoted to the correlation of metallography and mechanical test of metals (for extended abstract of this lecture see this issue). Dr. Moore pointed out that both branches of study have their limitations. He dealt with the quantitative basis of mechanical testing as contrasted with the qualitative basis of metallography, and pointed out that one of the questions with which both metallographers and engineers using mechanical tests are most concerned is how and when a fatigue crack starts in a metal structure. Another question being investigated is the resistance to spreading of cracks offered by the grain boundaries.



ROBERT PEELE, newest honorary member of the A.I.M.E. This distinction was a reward for his conspicuous educational work and ability as a consulting mining engineer.

Dr. Moore stated that only by co-operation between engineers and metallographers could much progress be made in prolonging the useful life of a metal by means of a proper understanding of its structure and physical limitations.

The annual lecture of the Institute of Metals Division was delivered Wednesday afternoon by Robert F. Mehl, director of the metals research laboratory of the Carnegie Institute of Technology. Dr. Mehl considered the subject of diffusion in solid metals. He stated that apart from its importance in such processes as chromizing, carburizing, nitriding, and calorizing, diffusion plays an important part in the homogenization, age-hardening and transformation of steel. Therefore, diffusion has considerable scientific importance.

FRANCIS H. CROCKARD, recipient of the J. E. Johnson, Jr., award for "meritorious contributions to the metallurgy of iron and steel."

According to Dr. Mehl, diffusion may occur within a grain of metal, along a grain boundary, or upon a surface, though the exact and even the relative value of these separate processes are known for only a very few cases. It was also said that some distortion accompanies diffusion, leading to little understood grain-size changes. This distortion assists diffusion though usually it disappears before diffusion has become extensive. In a binary system, the rate of diffusion is the more rapid in the lower melting metal. Age-hardening data on metals may be treated as diffusion data and rates of reaction in steel could profitably be studied from this point of view.

At the dinner of the Institute of Metals Division, Thursday evening, Francis C. Frary delivered a lecture sketching 50 years of progress in aluminum. Mr. Frary reviewed the early history of aluminum research, and then described Hall's difficulty in finding backers in his attempts to capitalize on his invention. Mr. Frary also pointed out that in 50 years, aluminum has grown to be an active competitor of well-established materials such as iron, copper and zinc, particularly in the field of transportation.

C. C. HENNING, awarded the Robert W. Hunt prize for his paper entitled "Manufacture and Properties of Bessemer Steel."

Williams Elected Chairman

The Iron and Steel Division of the A.I.M.E. elected Clyde E. Williams as its new chairman. Mr. Williams is director of Battelle Memorial Institute, Columbus, Ohio. Mr. Williams, in addition to his administrative duties at Battelle, has been in direct charge of technical work at the Institute having to do with the iron and steel industry since 1929. Prior to that he served as Chief Metallurgist of the Columbia Steel Corporation and as Superintendent of the Northwest Experiment Station of the U. S. Bureau of Mines. In 1924 he was a member of the commission which reported on the iron resources of Argentina for the Argentine Government.

CLYDE E. WILLIAMS, new chairman of the Iron and Steel Division of the A.I.M.E., director of the Battelle Memorial Institute, Columbus, Ohio, and prominent industrial metallurgist.

A special symposium on a subject which transportation leaders and metallurgists found of great interest, was the session devoted to trends in the use of alloy steel. Included on the list of speakers was H. W. Gillett, chief technical adviser of the Battelle Memorial Institute, who discussed the trends in the metallurgy of low-alloy, high-yield-strength structural steels, with particular reference to their use in transportation. (See this issue for extended abstract.) Zay Jeffries, consultant to the Aluminum Co. of America, similarly discussed developments in the light-metal field, while Prof. C. H. Mathewson of Yale University covered advances made in the application of the heavier non-ferrous metals.

Heading the transportation authorities on the program, A. J. Pelley, president of the Association of American Railroads, gave the keynote address. Other speakers were Walter William Colpitts (see this issue for abstract), railroad engineer and director of the Pere Marquette, Seaboard, and Milwaukee, St. Paul & Pacific lines, who discussed developments in railroad equipment construction; Merrill C. Horine, automotive engineer, talked on truck and bus design; Edgar B. Trask, naval architect, presented the marine point of view, and H. C. Knerr, an authority on construction materials in aircraft, revealed aviation trends.

H. F. MOORE

Research Professor of Engineering Materials, University of Illinois. Author of the 1936 Henry Marion Howe Memorial Lecture.

Correlation Between M

o o o

By H. F. MOORE

o o o

THE need of correlation between metallographic and mechanical tests of metals opens Mr. Moore's discourse. He points out that fruitful correlative studies have already been made in connection with the mechanism of elastic failure, creep and fracture of metals, and, also, the "slip-interference theory" is currently the result of much correlative study. Investigations of the important phenomenon of stress concentration have profitably combined the use of metallographic and mechanical examinations. After reviewing grain size, single crystal and strain-etch experiments, Mr. Moore points out that highly desirable fields of correlative study include mechanism of creep and metal fracture, the mechanism of aging, the resisting strength of grain boundaries compared with intra-crystalline metal, etc. The information presented on the following pages is an abstract of a much more complete manuscript which Mr. Moore presented before all divisions of the A.I.M.E. in New York on Feb. 20.

o o o

ABOUT a century after the Pilgrims landed at Plymouth, the French government caused to be made a survey of the manufacturing arts of France, and among the men who made that survey was Rene Antoine Reaumur (whose name is familiar in connection with the so-called Reaumur thermometer scale). In 1722 he published a monograph entitled "The Transformation of Wrought Iron Into Steel." In that monograph he described two rather crude testing machines—one for making tensile tests, and the other for making bend tests for ductility. He also showed a micrograph, hand-drawn, of course, showing the structure of steel. This micrograph is reproduced in Fig. 1. A translation of Reaumur's remarks concerning the micrograph seems worth giving here:

"Let us now consider a grain of steel—a grain which is visible to the unaided eye. That grain, which the eyes perceive easily, is itself an aggregate of other grains which we call 'molecules' of that grain. The microscope makes these 'molecules' visible to our eyes. MMM are the molecules of the grain, the number of which (molecules) is vastly larger than is shown here. The parts which show as white are the voids which are between the different molecules. The molecules of the grain are themselves composed of other parts, which we have called the 'elementary' particles of iron and steel."

This is a picture very different from the present-day ideas of the crystalline structure of metals, but it is an interesting pioneer hypothesis.

Now, so far as can be determined, Reaumur suggested no correlation between the structure of steel as he saw it, and its strength and ductility. That was 214 years ago, and we still find it difficult to correlate the message of the qualitative micrograph with its exhibition of localized irregularities of structure with the quantitative and generalized results of mechanical tests of metals.

There are two general problems of correlation between metallography and mechanical testing. These are (1) correlation between qualitative and quantitative test results, and (2) correlation between localized and average test results.

Two micrographs of steel with the same chemical composition may show markedly different grain structures, as illustrated in Fig. 2. Quantitative measurement of average grain size can be made, and correlation of this grain size with the quantitative results of a tensile test for strength is possible, but if an attempt is made to evaluate the effect of *shape* of grains, one is faced with a different kind of problem.

Observations of the shape of grains are almost entirely qualitative, and such observations form a basis on which to accept or reject the metal. However, one finds it difficult to set up formulas or to specify tolerance for such action. The requirement that a specimen

Metallography and Mechanical Testing

Thirteenth Howe Memorial Lecture

of steel shall show a sorbitic structure is a different kind of requirement from the specification that the tensile strength of the steel shall not be less than 120,000 lb. per sq. in. and not more than 135,000 lb. per sq. in. Fig. 3 may be of aid in visualizing this difference. In the tensile test result the tolerance is clear cut, and, if the test is properly made (note the *if*) the result is almost free from personal opinion. In judging the steel from the micrograph the verdict is "pass" or "fail," and there is a considerable chance for difference of opinion as to whether the structure shown is sorbitic or fine-grained pearlitic.

Need of Correlation

Correlation between metallography and mechanical testing is not going to be an easy task. Is it worth while or will it be well to let these two branches of the science of metals continue to follow separate paths, with few cross paths between them? Up to a short time ago the problem of strength of materials was of interest mainly to civil engineers in connection with structures which had to carry reasonably steady loads. For such structures the development of the mathematical theory of elasticity furnished a satisfactory basis for design, and studies of the crystalline architecture of metals were interesting, but not particularly necessary. The metallographist found his qualitative micrographs of use in connection with the production of metals, and neither metallographists or engineers paid much attention to the fact that the metallographist had discovered convincing evidence that one of the fundamental assumptions of the theory of elasticity, i.e., the assumption of homogeneity of material, was far from true for the metallic materials of construction. The metals which are actually in daily use are evidently *not* homogeneous. They are made up of crystalline grains of various orientation and varying strengths. They contain non-metallic inclusions. It is a most interesting technical bit of inconsistency, the fact that metallographists when they have to figure stress or strain **use the formulas of a theory which their own discoveries have shown to be founded on an assumption which is not rigidly true for the very metals they study.**

It may well be asked why we still continue to apply to actual metals the theory of elasticity if its foundations are not rigidly true. One answer is that, when applied to volumes of metal containing a considerable number of crystalline grains, the assumption of homogeneity is "statistically" accurate. The behavior of a volume of metal containing, say, a thousand crystalline grains can be predicted by the theory of elasticity just as the rate of mortality for a large group can be predicted by an insurance actuary. When considering minute areas, such as the area at the root of a screw thread, the limitations of the theory of elasticity begin to become noticeable. The major reason why this theory is still used is because no other usable theory has yet been developed.

Correlation Taking Place

As noted previously, quantitative study of effect of grain size is taking place in metallographic laboratories. The speaker can only refer to the recent remarkable developments of the McQuaid-Ehn test, with its emphasis both on the qualitative "normality" or "abnormality" of steel and on the quantitative factor of inherent grain size.

This matter of grain size, and of size of specimen, has recently appeared in connection with the sensitivity of different metals to notches and other "stress raisers." If we make fatigue tests on two sets of *small* specimens of fine-grained metal, one set notched and the other unnotched, the specimens with notches develop a fatigue limit much below that of the unnotched specimens. If, then, we make fatigue tests on two corresponding sets of small specimens of coarse-grained metal the weakening effect of the notch is usually much smaller than for the fine-grained metal. However, R. F. Peterson, of the Westinghouse laboratories, has recently reported that if corresponding fatigue tests are made on *large* specimens, both fine-grained metal and coarse-grained metal show a percentage of weakening due to the notch about

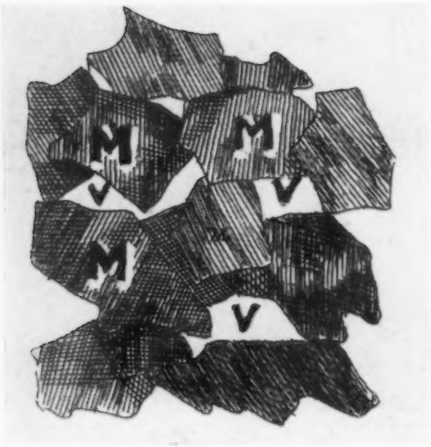


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FIG. 1—Grain of steel as seen through a microscope. This sketch was drawn by Reaumur in 1722.

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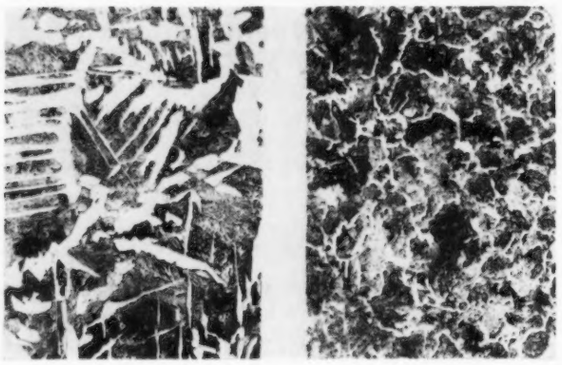
FIG. 2—Two pieces of steel which are identical chemically but have radically different grain structure. The steel is 0.55 per cent carbon axle steel as forged (left) and oil quenched and drawn (right). Photos are at 100 diameters and were taken by R. E. Cramer.



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as large as the percentage weakening for the small specimens of fine-grained material. Peterson made the dimensions of the notches in his large specimens geometrically similar to the dimensions of the notches in the small specimens.

Fig. 4 illustrates, or rather cartoons, the conditions of the tests. The speaker suggests the following hypothesis for Peterson's results: A fatigue crack starts in the same direction as that of plastic action (slip). That direction is always in one of the planes of maximum atomic weakness, even if that plane of weakness is not a plane perpendicular to a maximum tensile stress. In a member subjected to tension or to flexure this crack follows this plane of atomic weakness until it reaches a crystalline grain boundary, then changes direction as it crosses the boundary into another grain with different orientation of its planes of weakness. As the crack crosses grain boundaries there seems to be a tendency for it to take up a direction perpendicular to the principal tensile stress; and the final fracture looks to the unaided eye as if it were a crack perpendicular to the principal tensile stress.

The particular plane of weakness along which a crack starts is that plane of weakness on which the component of the nominal shearing stress is a maximum. Now in flexural specimens such as those shown in Fig. 4, the principal tensile stress is in a longitudinal direction, *and at the surface* the maximum shearing stress is in the direction of 45 deg. with the principal tensile stress. In the case of a small specimen of a large-grained metal the crack would tend to *start* in a diagonal direction (on the plane of atomic weakness most nearly in the direction of maximum shearing stress). It tends to spread beyond the region of high nominal stress near the root of the notch before it crosses many grain boundaries, and should not get a chance to start in a circumferential direction perpendicular to the principal tensile stress, as cracks usually do after they have spread a small distance. In the case of all the fine-grained metal specimens, and of the *large* specimens of coarse-grained metal, a crack once started would traverse several grain boundaries before it got beyond the region of high stress near the root of the notch and would have a good chance to start on its destructive spread in a circumferential direction.

The question, "When does a fatigue crack start, anyhow?" is still waiting a fully satisfactory answer, and the speaker is glad to note that the question is being attacked by means of the testing machine, the metallurgical microscope, and a study of X-ray diffraction. H. J. French, of the International Nickel Company's laboratories, has done pioneer work in determining what he calls the "probable damage line" as an important part of the fatigue test diagram. A number of laboratories are following up this (French's) method of study, which, it is hoped, may be used to determine combinations of stress and cycles which may be expected to start destructive fatigue cracks.

At the Massachusetts Institute of Technology, Professor A. V. deForest is using direct examination through the microscope to study fatigue cracks in the early stages of their developments.

A very interesting correlation is now being worked out by the Research Committee on Fatigue of Metals and the Committee on Metallography of the American Society for Testing Materials. Those committees are making an attempt to find some correlation between the indications of X-ray diffraction apparatus and the behavior of metals in repeated-stress testing machines. X-ray diffraction sometimes shows a type of pattern which is said to indicate "fragmentation." Whether this "fragmentation" is an indication of structural damage, i.e., destructive cracking, or whether it indicates a slight non-injurious disturbance in the regularity in the orientation of the squads of regularly arranged atoms (the space lattice units) is uncertain.

The correlation of X-ray diffraction and strength and ductility values is of especially great difficulty. The X-ray experimenter brings to the engineer a series of Laue diagrams and calls this one "good" and another one "bad." The engineer can see differences in

the diagrams but cannot see how that difference can be expressed in any quantitative way. The X-ray experimenter then speaks of differences in width of lines or of shift of lines which can be measured quantitatively, but so far he speaks hopefully rather than assuredly. Then, too, these X-ray diffraction indications are, in general, indications of general atomic arrangement within a crystalline grain. Any defects they indicate are systematic defects rather than localized defects. Now the engineer, especially the mechanical engineer, is very much interested in *localized* defects, defects which indicate danger of fracture, which is emphatically a localized phenomenon. Again we may use the life insurance analogy. The X-ray investigator may be compared to the actuary who can predict the general scheme of distribution of mortality in the city of New York during 1936, while the engineer may be compared to the man who asks whether there will be a death in his family during the same period. At present the X-ray experimenter cannot answer the engineer's questions. However, two facts must be kept in mind, namely, (1) the development of X-ray diffraction analysis is in the early stages of its development, and (2) it is the only experimental tool we have for studying the structural architecture of metals in fields too small for the microscope. Correlation is difficult, but its possibilities of value are so great that the search for connection between X-ray diffraction and mechanical test results is a most attractive research adventure.

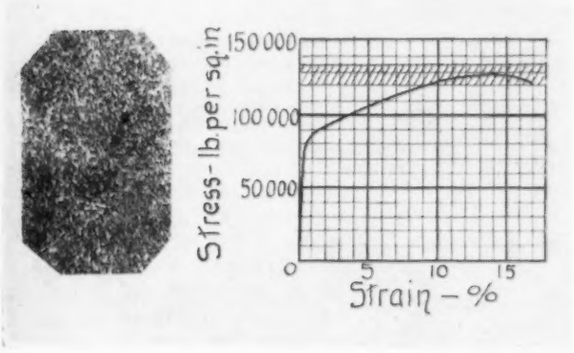

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FIG. 3—Micrograph and tensile test diagram (stress-strain) of the same piece of steel. The problem is to correlate these two types of tests.

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Unsolved Correlations

Now consider a few of the many unsolved problems of metallic materials, problems which will require for their solution correlation of metallographic and mechanical methods. The elasticians have developed a very elaborate system of computation of stresses and strain, and where their methods lead to differential equations beyond the methods of solution now available, and they frequently do lead to such equations, it is frequently possible to use mechanical, optical, or electrical devices for the practical solution of these equations. An example of this is the examination of stressed specimens of transparent material by means of polarized light. But the mathematical theory of elasticity, even with such aids, cannot tell us what magnitude of stress, strain or strain - energy causes *structural damage* to different metals under various conditions of localization of stress, of rapidity and repetition of loading, or of combinations of stress in different directions.

Engineers and elasticians have worked out some half-dozen theories of failure of materials. They are all based on ideal elastic materials, i.e., homogeneous and isotropic. It is not strange that, applied to actual metals, actual test results show a "scatter" so wide as to make it difficult to distinguish between the relative validity of the different theories. In solving this problem engineers have not cooperated effectively with metallographists, but they should do so. Already metallographists have drawn qualitative pictures, or, at best, semi-quantitative pictures of the mechanism of failure.

Another unsolved problem concerns itself with the nature, significance and tests for ductility and brittleness. The conventional answer to the question, "What is ductility?" would define it as that quality shown by great elongation and reduction of area in a tensile test. But that answer is not very satisfactory. By this criterion some metals which show high ductility develop cracks after a relatively few cycles of repeated stress, especially repeated stress at notches. A good elongation reduction of area does not guarantee satisfactory freedom from cracking under thousands or millions of stresses which cause slight localized plastic action. In this connection we must face the fact that under service conditions there is slight plastic action at dozens of minute areas in most machine parts and in some structural members.

As a matter of fact, if it were not for this slight plastic action few, if any, of our machine parts would hold together. The beneficial effect of slight, crackless

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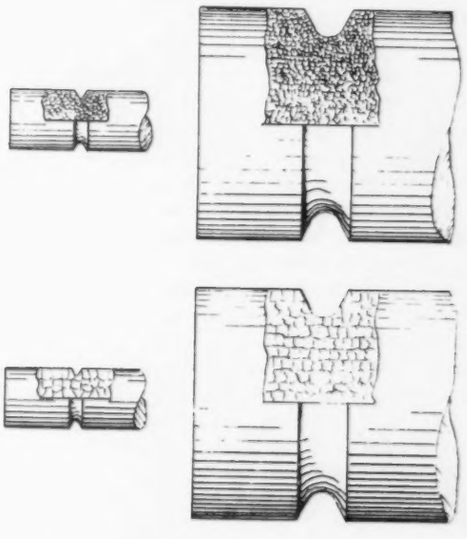
FIG. 4—Notch effect for fine-grained and coarse-grained metal and for large and small specimens. Large specimens of both fine-grained metal and coarse-grained metal show a percentage weakening due to the notch about as large as the percentage weakening for the small specimens of fine-grained material.



Physical Properties of Soft Solders; St

THE authors have carefully examined a phase of the metals industry which had never been afforded the attention it deserved. Soft solders are so universally used that they are taken for granted, and too often their application in various fabricating activities is based on rule-of-thumb methods rather than specific technical data. The information presented herein should help to correct the situation; for the authors establish reliable correlations between solder analyses and electrical conductivities, impact, shear, tensile and elongation values. Furthermore, the average user of soft solders can benefit by examining the results of actual soldering tests with various lead-tin compositions. The data presented on these pages are a condensation or abstract of a larger and more complete paper presented by the authors before members of the A.I.M.E. at their 145th meeting on Feb. 18 at New York.

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SOFT solders are used principally in the automotive, can making, building construction and electrical industries, but their field of usefulness extends well beyond these principal uses to a vast list of miscellaneous applications where metal joints are required. The most common soft solders and the only ones considered in this discussion are those composed of lead and tin, with or without various relatively small percentages of impurities or additions. A small amount of antimony is often purposely added. As an indication of the importance of these lead-tin solders, 8620 long tons were consumed in 1934 in the U. S., and during most of 1935 from 900 to 1000 long tons were used each month.

A great many factors influence the properties of joints made with soft solders. Fluxes and the fluxing procedure used to prepare the surfaces to be joined in order to give a true metal-to-metal contact are among the most important of these factors. The temperatures used, cleanliness of the work and general soldering technique are also important. It is the metallic solder itself, however, and the raw materials from which it is made that usually get the blame for unsatisfactory results. Sometimes criticism of the solder is justified. The wrong composition may be chosen for a given job, impurities may be present that ruin certain desired qualities or uniformity may be lacking. A solder may even be looked upon with suspicion because of its ancestry regardless of its true composition and behavior. To clarify the effect of slight differences in composition as found in commercially refined solders, a comparison of properties of solders grouped according to their origin has been undertaken. The results of this comparison are given herein.

This research seeks to give practical information on the properties of tin-lead solders produced from virgin metals, from commercially an electrolytically refined crude refined secondary solder, and from lead-tin refinery product. This paper gives the results of physical tests on the various solders as massive metal, and of tests on the comparative strengths of brass lap joints made with them.

Four series of solders were used in this work:

Series A—Virgin metals—Straits tin and desilverized lead.
Series B—Secondary solder, adjusted with Straits tin and desilverized lead.
Series C — Electro-refined crude solder, adjusted with Straits tin.
Series D — Electro-refined crude solder, adjusted with Chinese tin.

In each series, **eight metal compositions were used to cover the range of the most commonly employed solders. These were 15, 20, 25, 30, 35, 40, 50 and 63 per cent tin respectively, the remainder being lead plus 0.12 per cent antimony and impurities.** (No 15 per cent tin composition was made for series D alloy).

Electrical Conductivity

Specimens for electrical conductivity tests were cast in an open split mold, and measured approximately ¼ in. by 3/10 in. by 18½ in. These specimens were machined sufficiently to produce a square cross section, accurately measured by micrometer at inch intervals, and tested for conductivity 24 hr. after casting. Three specimens were tested for each alloy and the average taken as the conductivity. Variation between specimens of the same alloy amounted to much less than 0.1 per cent of the conductivity of copper.

The results of these tests are given in Table I, as calculated to the percentages of the conductivity of copper. The greatest variation be tween the four different solders is only 0.2 per cent of the conductivity of copper, hence for all practical purposes they may be

Strength of Soldered Joints ▲ ▲ ▲

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considered to have equal conductivity.

Series C alloy made from electrolytic solder adjusted with Straits tin, has a consistently higher conductivity through the most used solder range, 25 to 45 per cent tin. All the variations are explainable by comparing the impurities present. In the lower-tin solders the secondary metal gives the lowest conductivity; in the high-tin range the influence of impurities in the Chinese tin added to electrolytic solder becomes noticeable. Therefore, a summation of conductivity tests would indicate that **the purest solder, electro-deposited and adjusted with Straits tin, gives a slightly higher electrical conductivity through the most used composition range, but the difference in conductivity between the solders tested is too small to be of any practical importance.**

In order to compare the effect of aging on the electrical conductivity of solder, one bar from each alloy was retested after remaining at room temperature for from six to eight months. **An increase in conductivity of about 5 per cent occurred by aging throughout the alloy range for all the solders.**

Impact Strength

Five standard notched Charpy impact specimens were cast in one bar by using a split mold. The notches were cast in place and individual specimens were tested on an Amster impact machine approximately 24 hr. after casting. Two and sometimes four bars were tested, making a total of 10 to 20 tests for each alloy.

Results of the average impact values obtained are given in Table I. By treating the average from a five specimen bar as a unit, impact values usually varied less than one ft. lb., and for the high-tin solders the agreement of individual tests was still better.

In interpreting these results only general trends should be considered. The erratic results for Series D solder, which were checked, are very probably due to its variable copper content. Possibly the relatively high silver content of the Series B solder accounts for its difference in behavior, or its low iron content in the lead-rich solders may have an influence on the impact strength.

A summation of these tests would be that **the impact strengths of the solders made from virgin metals and electrolytic solder adjusted with Straits tin are nearly the same and reach a maximum with a tin content of about 40 per cent. Secondary solder containing silver and very small amounts of other impurities has a much higher impact that the other solders in the high lead range. The addition of copper to electrolytic solder appears to definitely injure its impact strength.**

Shearing Strength

To determine shearing strengths, three to six specimens were tested on each solder. These tests were made about 24 hr. after casting. Maximum variation in data obtained was 200 lb. per sq. in. Tests on many solders in the high tin range gave results with a variation of less than 75 lb. per sq. in. or a spread of less than 1 per cent.

Average results of the shear tests are given in Table I. The shear strength of the secondary and the virgin metal solders was nearly the same throughout most of the composition range. As would be expected, the purer electrolytic solder adjusted with Straits tin, Series C, was consistently lower in shear strength and appeared to fracture more gradually.

The electrolytic solder containing appreciable amounts of copper, bismuth and iron, due to the addition of Chinese tin, Series D, gave a much higher shear strength in the higher-tin compositions and was noticeably stiffer since it tended to break with a snap. It is probable that the difference in behavior of Series D solder is due to its copper content as the highest strength solder (50 per cent tin) coincides with the highest percentage of copper.

Tensile Strength

Considerable difficulty was experienced in getting sound castings in tensile bars and it was only after trying various kinds of molds, graphite as well as steel, various dimensions for the specimen and risers, and many changes in procedure that consistent results were secured. Great care in uniformly and thinly coating the parallel section of the mold with acetylene soot, with a heavy coating on the shoulders, riser and sprue, was found to be very important. Tensile bars were all annealed for 16 hr. at 100 deg. C. before testing. This was largely to relieve any strains

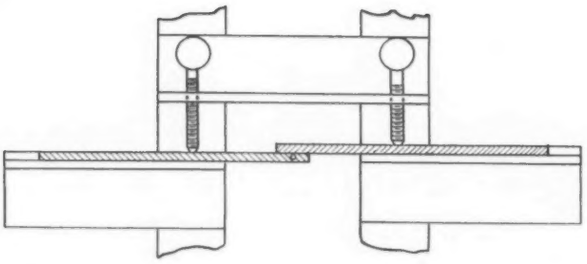

FIG. 1—Apparatus for making and testing soldered lap joints. This jig holder assures exact duplication of soldered areas. The jig is adjustable to give definite control of the overlapping and clearance of the joints.

that might be established in removing the bars from the mold and effect stabilization.

Results of the tensile tests, an average of three tests on each solder of a given composition, are given in Table I. The strengths at any given tin-lead composition of each of the four classes of solder do not differ by as much as 10 per cent. As in the shear tests the purest solder, Series C, consistently gave the lowest strength throughout. Likewise, the Series D electrolytic solder, containing impurities from the Chinese tin added to bring the tin content above about 25 per cent, gave consistently the highest strength. This may be attributed largely to the copper in the higher-tin compositions of this solder. As in the shear tests the secondary solder and virgin metal solder gave almost identical values. Variation in results between the three samples tested for each solder did not exceed 2 per cent and usually varied much less than that.

Values for non-annealed tensile specimens would be much higher than those secured in these tests. A faster rate of testing would also greatly raise the tensile strength results. As cast, the A63 alloy (63 per cent Sn) was over 20 per cent stronger than after annealing, and the A40 alloy was over 16 per cent stronger before annealing.

The low values for the 40 and 50 per cent tin solders may be due to relatively slow cooling before removal from the molds. Exactly the same testing procedure could be followed for all alloys of the same composition but it was not always possible to treat different compositions in exactly the same manner. Partial annealing in the mold at high temperatures may have affected the strength of these two compositions.

Elongation

The average elongations of the tensile specimens are recorded in Table I. Although somewhat erratic, the general trend from low values in the lead-rich solders to a maximum in the 50-50 region is quite marked.

Irregularities in elongation may be due to very slight differences in the internal structure of the specimen, as well as to possible slight variations in casting technique such as uniformity of soot on the molds.

Elongations of up to 150 per cent have been secured on some of the 50 per cent tin solders that were cast into a mold at 60 deg. C. and pulled with a free cross head travel of 0.1 in. per min. in place of the usual 0.5 in. per min. rate. The 50 per cent tin solders, either as cast or annealed, were found to show decidedly greater elongation than any of the solders from 15 to 63 per cent tin which were subjected to similar treatment. From a limited number of tests elongations were found to be about the same whether annealed or not.

Soldered Joint Tests

In attempting to determine differences in strengths of soldered joints due to comparatively minute differences in solder composition it was decided, after preliminary tests, to use a comparatively simple inexpensive type of joint such as a single lap joint. Such a joint gives a combination shear - tensile loading such as is met in most types of service.

Joint members were made from half-hard, cold drawn 70-30 brass. Solders used in these joint tests were the same as used in making physical tests. All joints were fluxed with an aqueous solution of

TABLE I—*Physical Properties of Lead-Tin Solders*

Per Cent Tin	Conductivity Per Cent of Copper Standard at 30 Deg. C. Alloy Series				Charpy Impact Ft.-Lb. Alloy Series				Shear Lb. Per. Sq. In. Alloy Series				Tensile Lb. Per. Sq. In. Alloy Series				Elongation Per Cent in 2 In. Alloy Series			
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
15	8.40	8.38	8.36		8.7	12.2	12.5 10.9		4470	4690	4500		5680	5590	5610		18.0	16.5	17.3	
20	8.73	8.63	8.61	8.68	12.2	18.9	12.4 12.2	14.2 14.3	4740	4870	4690	4970	5800	5730	5320	5630	16.0	18.0	12.0	18.0
25	8.98	8.88	9.04	8.95	13.4	18.9 17.5	11.7 15.7	10.8 13.1	5310	5260	4850	5180	5990	5830	5700	5890	27.0	21.0	21.0	21.0
30	9.25	9.23	9.37	9.32	17.7	18.1	17.7	15.6 17.1	5500	5430	5240	5640	5990	5890	5780	6110	31.0	35.0	30.0	31.7
35	9.59	9.54	9.79	9.57	18.6	17.7	19.5	14.1 15.0	5590	5610		5890	6280	6210	6050	6500	26.0	40.0	35.0	40.0
40	10.08	9.98	10.16	9.99	19.0	17.4	19.7	16.4	5680	5750	5660	6090	6250	6320	6080	6480	49.0	45.0	50.0	39.5
50	10.91	10.78	10.90	10.74	15.9	16.1 15.7	16.7	16.3	5870 5860	5870	5770	6320	6090	6130	5950	6360	74.0	72.3	61.9	60.5
63	11.82	11.79	11.76	11.70	14.2 **14.1**	14.5	13.0	13.9	6060	5920	5890	6230	7490	7570	7060	7680	29.5	27.5	33.7	38.8

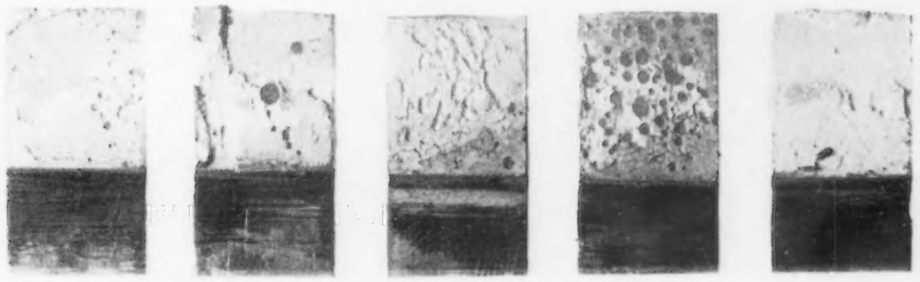

FIG. 2—Brass lap joints made by the closed method of soldering. These pictures show the porosity and flux inclusions resulting from this method. From left to right the samples are C-35, A-15, C-25, C-63, and C-63.

zinc chloride and ammonium chloride in approximately the eutectic ratio of these salts, i.e., a 5:2 ratio.

Fig. 1 shows a sketch of the jig used to hold the joints while they were being soldered. The soldering temperature is manually controlled and was measured by means of a small thermocouple inserted in one of the pieces to be joined through a hole 0.0785 in. in diameter.

Two methods of soldering the joints were used. In the first or "closed method," the properly prepared members, rigidly fixed in the jig at a definite joint clearance of 0.007 in., were soldered in place in the normal way and no change made until the solder had solidified. In the second or "open method," which gives a much better joint, the same preliminary procedure was followed, but instead of holding the joint open to only 0.007 in. during the actual soldering operation it was opened to about 0.030 in. After the solder is applied the joint is squeezed back to the normal 0.007 in. opening while maintaining the same soldering temperature.

Joints were made by the closed method on each solder until sufficient solid joints were produced to give a fair comparison. Only a few were required on the 35 and 40 per cent tin solders because they were comparatively free from porosity. The most trouble from porosity was encountered in the high-lead solder, probably because of their greater viscosity. Porosity in the high-tin solders seemed to be due to poor wetability of the joint surfaces under the conditions used. Fractures of typical joints made by the closed method of soldering showing different degrees of porosity are illustrated in Fig. 2.

By using the "open method" of soldering porosity was practically entirely eliminated from all joints regardless of the composition. The wider opening between the joint members when applying solder permitted a washing action that insured a thoroughly wetter surface, whereas the very thin opening used in the closed method encouraged the trapping of flux and air. Typical fractured joints made by the open method are shown in Fig. 3.

The open method of making joints was so effective in eliminating unsoundness that results with this method are much to be preferred over these of the fixed closed joint. The latter proved advantageous in a qualitative way, however, for determining those solders which gave the best fluidity and were least affected by any tendency to form porous spots and flux inclusions when solder is run into narrow joints. Higher average values were obtained by the open method and, in general, less scatter of results.

Series B solder, made from secondary metal, was qualitatively the best of the four classes of solder for producing good joints. Solders of Series A and C were improved the most by changing to the open method of making the soldered joints. Values were raised and less scatter in results secured. Considering the four solders as a whole, however, the strengths of soldered lap joints secured were very similar for any given composition. In all cases the strength increased with fair uniformity as the tin content was increased, within the limits of the compositions studied.

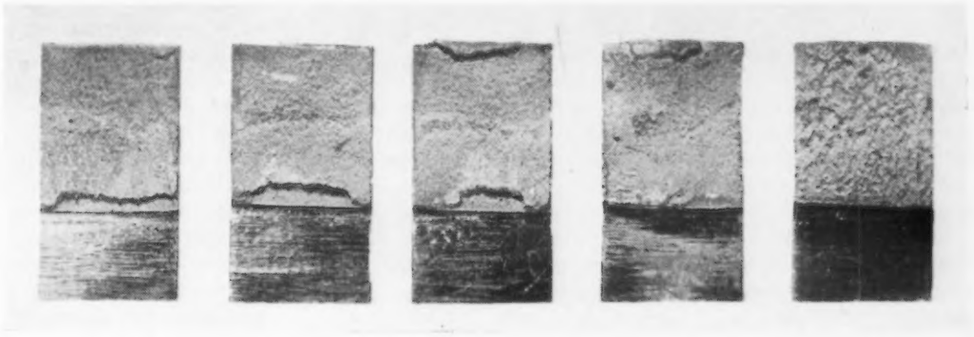

FIG. 3—Representative brass lap-joint fractures of soldered joints made by the open method. These joints were made with Series A solder. Reading from left to right the analysis is 15 per cent tin, 25, 40, 50 and 63 per cent tin. Compare these firm joints with those shown in Fig. 2.

Microscopic Study Of Ancient Bronze and Copper

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By C. G. FINK[1] and E. P. POLUSHKIN[2]

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THE authors have studied the microstructure and patina of ancient bronzes and coppers to the end of establishing differences between metal of that period and metal of today, and, also, to determine the effect of extremely long periods of corrosion on the structure of bronze and copper. It has been found that the difference between old and modern metals is not always very pronounced. In fact some ancient objects are almost free from the usual impurities and their structure is normal in every respect. Investigations of corrosion phenomena have revealed six typical cases or distinct types of corrosion of copper and bronze. The account of these experiments which follows is an abstract of a more complete paper which the authors presented to A.I.M.E. members at New York on Feb. 18.

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A PART of the material incorporated in this paper was derived from the studies of ancient metal objects examined by the authors from time to time for museums and art collectors, in order to verify the age of the metal. The data thus accumulated during several years were systematically surveyed and supplemented by new material obtained in examination of a set of specimens that had been generously donated by museums for this study. Altogether over 50 pieces were investigated, of which 39 are described in this paper. Every specimen is at least 1500 years old; the majority are considerably older. Exact conditions to which these bronze and copper objects were exposed in the ground are unknown, unfortunately. It is safe to say that exposure conditions did not remain constant during the long period of burial.

As the majority of specimens were very small and sometimes had a heavy coat of patina, or crust, which further reduced the amount of metal available for analysis, quantitative chemical analyses were not made. Small detached specimens were not always obtainable and in some cases studies had to be made on the statue, or other object, itself.

The approximate composition of each specimen was determined by examination under a microscope. . . . Small detached specimens were mounted in fusible metal and polished in a conventional manner. . . . A dentist's drilling equipment was found to be admirably suited to the task of polishing small sections of large statues or other art objects. . . . Inasmuch as diffuse light is indispensable in the examination of patina, this method of illumination was employed in all cases.

The number of copper specimens

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[2] Consulting Metallurgical Engineer, New York City.

available was comparatively small; two, Chinese and Hittite statues, were found to have been cast and annealed (see Figs. 1 and 2). Grains are polygonal and uneven in size but not very large. The Chinese statue contains lead. Both metals have numerous small inclusions of different color, sometimes with duplex structure. Other impurities occur as films on grain boundaries. But the amount of cuprous oxide is surprisingly small considering the age of the metal.

Fig. 3 shows the structure of an ancient scraper from Nuzi Irak. The metal is wrought copper with small polygonal grains, which at the edge of the scraper were distorted by cold-work. Evidently the edge was hammered out cold to make it sharper and harder. This treatment of the cutting edges of tools was common in many ancient countries.

The microstructure of three copper nails, one Roman and two from Nuzi Irak, appeared to be the same as in modern wrought copper, except that the metal was not as clean; likewise, the structure of a very ancient piece of wrought copper from Kish (3000 B.C.) is of this type.

In all specimens examined by the authors the proportion of copper oxide did not differ much from that in standard copper of our own time. It seems that the ancients knew how to protect the liquid metal from oxidation. A substantial difference, however, was found in the amount of other impurities, which were always higher in the old metal. They occurred as inclusions of various colors, or films on the boundaries of grains, and sometimes in solution with copper. When in solution, the presence of impurities could be disclosed by etching. The proportion of lead was not large and in some specimens it could not be found at all. The chemical composition of ancient copper is exemplified by the three following analyses:

Chinese battle-axe heads (Chow 1122 to 256 B.C.): Cu, 98.3; Sn, trace; Pb, trace; and Fe, 1.7.

Egyptian dagger: As, 0.39; Pb, trace; Fe, 0.08; copper by difference, 99.53 (oxygen omitted); Bi, Sn, Ni, nil.

Egyptian copper knife (Attributed to XVIII dynasty—3500 years old. In a splendid state of preservation): Pb, 0.63; Fe, 1.18; Bi, 0.44; Sn, 0.03; Ni + Co, 0.26; and As, 0.81.

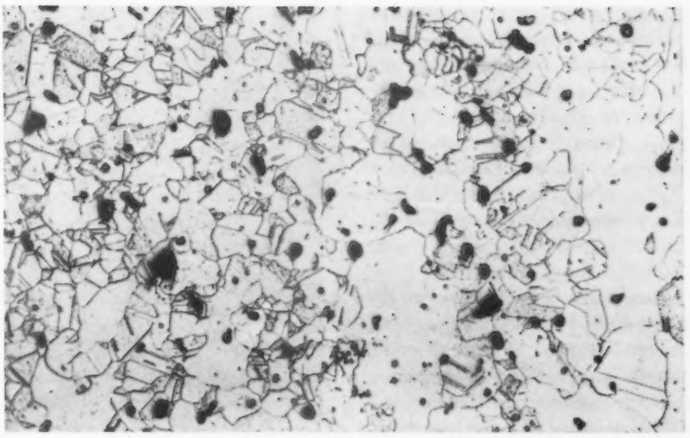

FIG. 1—Microstructure of a cast and annealed copper Chinese statue. Photo taken at 100 diameters. This statue contains lead and there are numerous small inclusions.

To sum up the results of the microscopic examination of ancient copper, it is distinguished from the modern metal only by the presence of certain impurities, and, as we shall see later, by microstructural aspects of its initial corrosion.

Structure of Ancient Bronze

The proportion of tin in the bronzes examined varied from 2 to 3 per cent up to 26 per cent, and their structure, therefore, also varied considerably, from low-tin alpha as sole constituent to eutectoid alone. A great majority of the specimens were of cast metal. Fig. 4 represents a typical case. The metal has dendritic structure, which is characteristic for cast solid solutions in general. It consists of nonhomogeneous alpha and eutectoid. At the first glance this structure appears normal, and this specimen could easily be taken for the modern bronze, but some of the eutectoid has been stained black (dots in Fig. 4). This staining is well seen under high magnification.

The change in the color of eutectoid was caused by infiltration of a corrosive liquid through the bronze and is a sign of a peculiar type of corrosion that is observed in ancient bronzes. In some other specimens corrosion attacked first the alpha constituent, producing rough spots in it. These insignificant appearing marks prove the antiquity of the metal. Another distinctive feature of ancient bronzes is the unusual appearance of eutectoid. In modern bronze it consists of two clearly separated elements, delta and alpha, while in many old

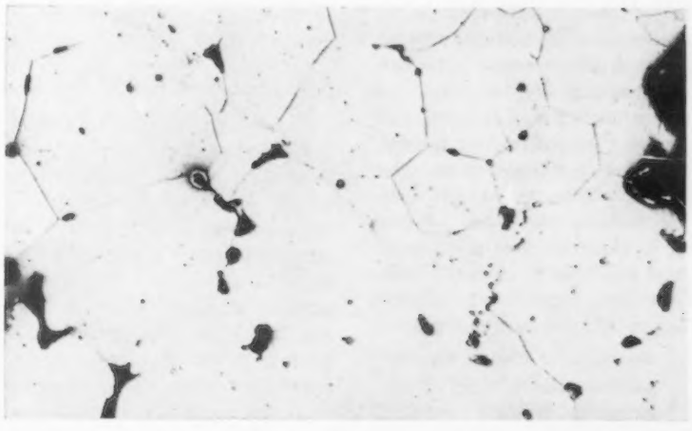

FIG. 2—Microstructure of a cast and annealed copper Hittite statue. Photo at 200 diameters. There are some impurities as films at the grain boundaries, but the amount of cuprous oxide is surprisingly small.

bronzes eutectoid is contaminated with some other components. Contamination of the metal with impurities can easily be explained by the crude methods of making bronze and the impure raw materials of early epochs. For the same reason, a great majority of the specimens contain numerous inclusions. Tin oxide and copper oxide are found in large quantities. Besides, there are some other inclusions and films that are not present in modern bronze. They vary in color and shape, and sometimes have double contours with the center different in color or in hardness from the periphery.

The proportion of tin in ancient bronzes may be as high as 20 to 25 per cent and sometimes even 30 to 31 per cent. The metal of this type was used in old China for casting mirrors, bells, swords and halberds, arrow heads and also for spoons and water pots. Roman and Etruscan mirrors were also made of this bronze. It is evident that the high reflecting power of this metal was widely known to the ancient world. Bronze with 25 to 26 per cent tin consists entirely of eutectoid; with further increases of tin, it is a mixture of eutectoid and delta. Both constituents are hard and brittle.

Hardness of high-tin bronze was certainly known to the ancients, who used it for making weapons. Moreover, they were familiar with the effect of rapid cooling on the properties of this metal. This statement we base on the examination of mirror 42, which was made of two kinds of bronze. One, forming the back of the mirror, was alpha with a large amount of lead; another, underlying the front face, was mostly eutectoid with a small amount of lead. Examination of the border zone proved that these metals gradually merged into one another, without any distinct demarcation line. It was evident that they had not been fused or welded together, but produced from the same melt. This could be done only by chilling the back of the mirror, so that the first portion of the metal solidified was low in tin while the last portion was highly enriched in this element.

The proportion of lead in ancient bronzes varies within wide limits. Some specimens contain only a trace of it, if any at all, while in Chinese bronze coins current at the time 722 to 481 B.C. lead is 40 to 55 per cent. In the authors' set of specimens, the highest proportion was, perhaps, 30 to 40 per cent. As impurity, lead was probably introduced into the bronze by the impure tin or copper, but when present in large quantities it was undoubtedly purposely added in order to lower the melting point of the metal and improve its casting property. Von Bibra, who analyzed many ancient bronzes, holds the opinion that lead was never found in bronzes of the true Bronze Age, and, consequently, its presence indicates the attainment of a higher stage of culture.

Zinc is also occasionally found in ancient bronze. Gowland and others maintain that the first occurrence of zinc as an intentional addition to copper dates from Roman time. C. Wang found that in Chinese bronzes zinc occurs from the first century B.C., but examination of ancient records indicated that it had not been recognized as a distinct metal until the 14th century A.D.

FIG. 3—Microstructure of a Nuzi Irak scraper. This is wrought copper cold-worked at the edge. Photo taken at 200 diameters. The small polygonal grains are distorted at the edge by cold work.

Microstructure of Patina

Copper and bronze articles taken from the earth or graves are covered with patina, which is a product of chemical reactions between the metal and underground water, air and other chemically active substances. It is very difficult, if possible at all, to visualize the real conditions in the ground where ancient metal has been lying for centuries. Many chemical agencies, such as ammonia and organic acids in the soil, were, perhaps, instrumental in the formation of patina, in addition to carbonated water and air. Electric currents in the ground might have exerted a powerful influence on the course of corrosion. These numerous factors were undoubtedly responsible for the great variety of minerals that were so far identified in patina. Their list includes the following copper compounds:

Oxides.—Cuprite, tenorite.

Carbonates.—Malachite, azurite.

Sulfides. — Covellite, chalcocite, bornite, enargite.

Chlorides. — Atacamite, Nantokite.

Silicates.—Chrysocolla.

Besides, there are lead, tin and iron compounds: cerussite, lead chloride, lead hydroxide, cassiterite, pyrite, markasite, and others.

The fact also must be considered that patination processes have not been always completed, consequently there must be some intermediate products of reactions in patina, such, for instance, as solid solutions.

External appearances and color of patina may vary considerably. Usually it has a more or less rough surface, warty or powdery. But some bronzes have so-called noble patina, which has a smooth, enamel-like surface with all details of the original contours distinctly visible. It is the most desirable type. This noble patina was formed by slow oxidation of dense and homogeneous fine-grained bronzes with smooth surfaces. It has different colors. Another variety is crystalline patina, in which the outlines of crystals are clearly visible.

The most common color of patina is green, with bluish and grayish tints.

Other ancient bronzes are deep blue, gray, brown or black. Patina of the last three colors is attributed to the presence of lead in bronze. According to our findings, no matter what the intermediate copper product may be—a basic chloride or sulfate—the ultimate product is malachite, a basic carbonate stable in the presence of CO_2.

Our study of patina was chiefly concerned with its microstructure. The component minerals were identified visually by examination of their color and structure in both normal and diffuse light. By this method, all common minerals could be identified, but for many others, microchemical tests were needed, which are not yet completed, and for this reason their nature still remains unknown.

Our present observation indicated that in all cases where corrosion is merely an oxidation process, resulting only in the formation of oxides and carbonates, the innermost layer of patina is always cuprite, or cuprite and tenorite. Formation of cuprite starts during the initial corrosion. Even in the presence of other corrosive agents such as chlorine, cuprite is frequently found in the first corroded layer in association with other products. Malachite and azurite are never found in direct contact with the original metal.

It should be noted, however, that the term cuprite is not used here in the true mineralogical sense, but in a broader sense to cover all mineral products of patination process in which Cu_2O is a predominant part. It may, for instance, contain tin derived from the corrosion of eutectoid. So long as it displays red color in diffuse light and bluish gray in reflected light, it has been called, conditionally, cuprite. With the same reservation, we use here other terms of minerals found in patina, such as malachite, azurite, etc. No doubt, in many cases they are transitory products of corrosion with varying composition. And, in contrast to true minerals, which also occur in patina, should have specific names.

Outside layers in patina generally are older than inside layers, but not always. Mineralization of the metal involves changes in volume and produces fissures which often run parallel to the layers of patina. Corrosive liquids penetrate into these fissures and deposit metallic copper or cause chemical changes in the adjacent zones of patina.

On account of parallel deposition of its component minerals, a patina may have a branded structure. Usually the bands or layers are not numerous and they all follow a certain order, indicating successive stages of patination process. In some specimens, however, the patina shows a large number of various layers without any visible relation to the stages of corrosion. This zonal structure is very characteristic in the patina of ancient Chinese bronze (cast bronze, tin 12 to 15 per cent). There are 75 different bands or zones in the cross-section of this patina, ¼ in. thick. The inner zone, next to the metal, is impure cuprite, the outside zone is malachite. The intermediate zones consist of cuprite and malachite alternating with components of different colors: orange, black, greenish black, greenish gray, yellowish green.

In examining the patina microscopically, light bands represent cuprite; dark bands, malachite and all other components. In a part of the cross-section all dark bands contain eutectoid. It may be clearly seen in the dark bands adjacent to the metal, but gradually disappears toward the outside surface. Light bands are free from eutectoid throughout the cross-section. The presence of eutectoid in the dark bands only and the periodicity of its occurrence suggests that the zonal structure of this patina was probably due to certain periodic heterogeneity of the metal. Further investigation reveals that the original metal had had a very coarse dendritic structure, and that corrosion of parallel axes of dendrites has given rise to white bands, while corrosion of the interaxial portions of metal in which eutectoid was embedded has given rise to dark bands.

Nevertheless, this explanation cannot be applied in general, as the zonal patina has been found in such metals in which it could not be attributed to the dendritic structure. In these cases another explanation of its origin should be sought. It is probable that this structure was produced by rhythmical changes in the concentration of corrosive liquids diffusing through the metal. These changes might have been caused by the rotation of seasons. The authors hope to enlarge upon this and other points in a subsequent communication.

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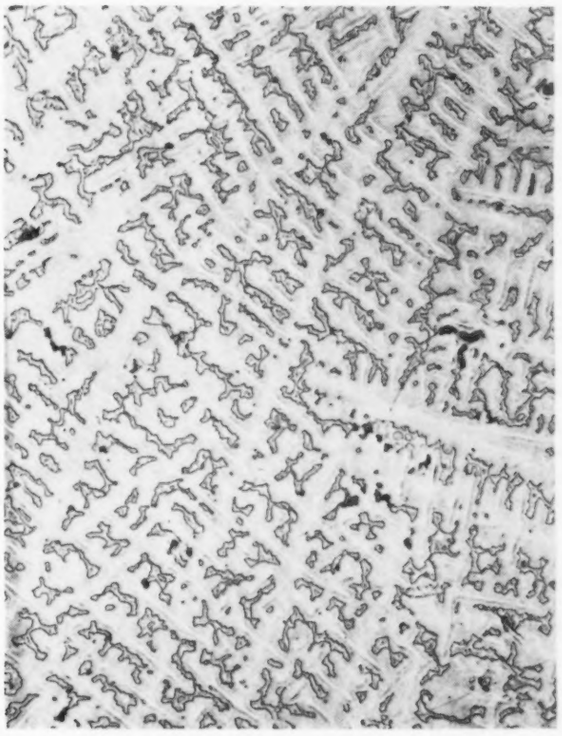

FIG. 4—Microstructure of a Chinese bronze head. This statue was cast from bronze having a tin content of about 12 to 15 per cent. Photo at 200 diameters. The metal has a dendritic structure and consists of nonhomogeneous alpha and eutectoid.

The Railroads and Light-Weight

THE author is an able railroad engineer and a director of the Pere Marquette, Seaboard, and Milwaukee, St. Paul & Pacific Railroads. Naturally enough, in these capacities he is in a position to view the recent trend of railroads toward alloy light-weight construction in an authoritative manner. Mr. Colpitts' thesis is that most railroads are in pressing need of additional revenue, consequently they must take steps to tap the reservoir of passenger traffic inasmuch as there is no great volume of additional freight available no matter what improvements are forthcoming in rolling stock. With this in mind, therefore, the author points out that the conventional type of heavy-weight car has had its day and that a new era in passenger train construction is dawning. This abstract of Mr. Colpitts' paper is a portion of a larger manuscript presented during the symposium on the role of metals in new transportation at the annual A.I.M.E. meeting last week in New York.

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TO me, as to many other students of railroad needs, the necessity for reducing dead weight in railroad rolling stock, both passenger and freight has been apparent for many years. The problem of weight reduction of passenger cars is so entirely different from that of freight cars, is so much more to the fore at the present moment and would seem to be so much nearer solution, that I shall confine my remarks to the former.

On the surface of things there would appear to be no close association of thought between the decline in traffic on the railroads, which is largely responsible for their present deplorable financial condition, and new metal alloys. It sounds like a trick riddle a schoolboy might propound to his parents. But I believe that there is a relationship between the two, and that it bids fair to be of great mutual benefit to the railroads and the makers of high strength metal alloys.

I know you have often wondered why railroads have not made more rapid progress in the use of metal alloys in reducing the weight of their equipment, but it must be remembered that it is only within the past two or three years or so that these new alloys have been available at a price which would permit of their use in large structures of any kind. Therefore, in this short time the whole technic of new train construction has had to be devised, and it cannot be said that this technic has as yet been nearly standardized.

The first question a railroad executive asks today, when a proposition involving a considerable expenditure is presented to him, is: "What am I going to use for money?" In addition, when he already has a large surplus of the things it is proposed to displace, such as, for example, passenger cars, his position, as you will readily perceive, is a difficult one.

These are some of the obstacles, but by no means the only ones, in the way of introducing light-weight passenger trains. The railroad executive must be convinced that the newer type trains, either by inducing additional traffic or by reducing operating expenses, will pay for themselves in a reasonable length of time. I am myself firmly convinced that in a great many situations they will, and it might be profitable to discuss that phase of the question for a moment.

Since 1920, when automotive competition began to assume serious proportions, the railroads have lost over 60 per cent of their passenger traffic. In the meantime, the use of the automobile has grown by leaps and bounds until now the passenger mileage in automobiles is probably 20 times that in railroad cars.

Passenger and Freight Problems Differ

I wish to emphasize that potential railroad passenger and freight traffic are in quite different categories in respect of the volume that it is possible to retrieve from the highways. In the case of freight traffic perhaps 15 per cent has been diverted to the highways, and I believe it can be said that this is so firmly held as to offer the greatest resistance to restoration of any considerable part of it to the rails. That is to say, there is no great mountain of freight traffic not already moving by rail that the railroads may draw upon, as in the case of passenger traffic, except as it may be created by an improvement in general business conditions. But passenger traffic on the highways of this country has grown to a tremendous volume, far beyond the most hopeful expectations of 15 years ago, and at least a part of this traffic, sufficient in amount to be of vital importance to the railroads, presents no resistance whatever to transference to the rails, providing the necessary inducements are offered. Permit me to say, then, that in my opinion the first and most important of these inducements the railroads must offer the public is travel cost comparable with that by automobile, and the second is high speed and frequent service in trains equipped with modern conveniences and comforts. I further believe the two should be combined and introduced on a broad scale to be most effective.

If, therefore, by aggressive and concerted advertising in the interest of the industry as a whole, especially stressing the greater safety of travel by train, the free-

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Equipment

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By W. W. COLPITTS

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dom from strain and discomfort, the fact that at the end of any journey automobiles may now be hired at small expense, and, most important of all, the lower cost of train travel, if and where that is a fact; and if also, by the introduction of fast trains, with frequent schedules, in which every modern means for appealing to the passenger is to be found, only one-twentieth of the passenger-mileage on the highways were diverted to the railroads, it would double the latter's passenger traffic. There are a lot of "ifs" in this sentence, but to promote progress in inducing passenger traffic to move by rail I feel they are all essential. It is no small undertaking; but to reverse the cycle of the past, by providing service that will induce new traffic so that the additional traffic will justify still better service, and so on, round and round, is a goal well worth taking a few business chances to attain.

I do not intend it to be implied from anything I have said or will say that fast trains will justify themselves in diverting traffic to the rails on all sections of a railroad, or even on any section of many roads. The question of where they may be introduced to advantage is one which involves a careful study of all of the conditions surrounding the traffic of the particular route, the volume moving by highway and a determination of the amount that may reasonably be subject to diversion, the effect of diversions from slower trains to the fast trains, the problem of connections with other trains, etc., etc. Each prospective route must be considered on its own merits but it is probable that each new fast train installation will provide data from which to judge the prospects for others.

This much is certain, therefore, that the railroads are in pressing need of additional revenues, and that there now exists a reservoir of passenger traffic of vast proportions from which they may draw if properly implemented. And it is also apparent that this reservoir has as yet scarcely been tapped. To make further headway in this direction is quite as much the task of the metallurgist, the metal manufacturer and the engineer as it is of the railroad executive. It is they, rather than the railroad executive, to whom we look to provide the metals most effective in reducing the weight of cars, to produce these metals at prices within the reach of poor but courageous customers, and to design the vehicles to meet all of the requirements of strength and suitability.

I would say that the attitude of the railroad man with respect to the nature of the metal alloys to be used in train construction is one of indifference. In the last analysis what interests him is the type of train that is the safest, that appeals strongest to the traveling public, that is capable of at least as high speeds as any other, and that can be operated cheapest, considering all ownership charges as well as all direct and indirect operating costs. That train will win in the race which best meets these specifications, whether it is of the heavy conventional type, streamlined semi-light-weight or light-weight, whether built of plain carbon steel or of the newer metal alloys.

I believe that, from the experience so far gained in the operation of high-speed trains, the feeling is fast gaining ground that the conventional type of heavy-weight car has had its day and that a new era in passenger train construction is dawning. This statement is not intended to infer that the present equipment is suddenly to be discarded, but it does seem probable that the streamlined train, because of its many points of superiority, will force its way into the higher class and specialized services as rapidly as the cost of substitutions can be borne, and that the heavy conventional equipment will be assigned in due course to the slower and less important services. Both the streamlined semi-light-weight and light-weight trains have, I think, already proven their case where travel appeal, high-speed with safety, least destructive effect on track and low operating cost are the criteria. Of course, this is an opinion which cannot yet be asserted with full assurance, but facts are now available, or are in the making, which will determine the question within a comparatively short time. I believe, however, it is at least sufficiently well established to warrant the statement, as astounding as it may seem, that it is improbable new cars of the heavy conventional type will be built.

To my mind the area of doubt as to the type of train that will find greatest favor in the future lies between the semi-light-weight trains, built of plain carbon steel as the extreme of low pound price on the one side, and the light-weight trains of the new metal alloys of high pound price on the other. It would appear, then, that the battleground will be confined within this area so far as cars are concerned. Another conflict will rage between the advocates of the steam locomotive and the Diesel.

A complete presentation of the properties of those metal alloys which are suitable for railroad train construction would be very lengthy and would involve a discussion of such subjects as ability to resist corrosion, workability, toughness, modulus of elasticity, effectiveness of welds and rivets, etc., all of which subjects have been treated by other speakers. (See article which follows.—Ed.) I shall merely state, therefore, the important factors with which the engineer must deal in preparing his designs are unit strength and unit cost. However, it should be recognized that the yield point is a determining factor in design.

The materials from which all the recent light-weight cars have been

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Trends in the Metallurgy of Low-Alloy,

ONE of the most active phases of the steel industry today is this subject which Mr. Gillett discusses. The author is of the opinion that with the advent of commercial high-yield steels, a new epoch of structural steel has been entered upon. Although there is some uncertainty as to just what compositions will survive in the current competitive period, it is contended that some of them, or at least some recently improved ones, will secure a permanent place as a constructional material for both moving stock and static constructional work. The author deals with all the current low-alloy steels now being marketed, examines their metallurgical history and present status, and looks into the future to find what improvements should be forthcoming. The abstract of Mr. Gillett's paper which appears on the following pages is only a part of a more detailed manuscript presented during the symposium on steels for transportation purposes at last week's A.I.M.E. congress in New York.

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WE hear much in these days about "tailor-made" steels. Far-seeing executives have sensed the demand for metals of improved and special properties, with those properties deliberately built into the steel in order to fit it for a particular use or group of uses. They have set their metallurgists at work to produce what the customer needs, even though the tonnage required may not, at least at first, be great.

As the metallurgists bring out such metals, the products are advertised and the customer becomes increasingly conscious that he no longer has to take "ready-made" steel as the only thing available, whether it fits his needs or not, but that there are plenty of steel makers ready to serve his specific needs with a tailor-made steel.

Of course, there is nothing new in the realm of rather highly alloyed steels to be heat-treated. The automotive industry demanded and got such steels long ago. Indeed, one could not design a modern car using only non-heat-treated carbon steel, since an engine of present horsepower would be so heavy that the gasoline required merely to lug the engine itself around, would be absurd. Many different alloy steels and many different heat-treatments are required to produce the fine gradations of properties and the strength per unit weight that are needed in each particular part.

Aircraft designers of course count a high strength-weight ratio in the materials used as Article I in their constitution, and they, too, and in outstanding degree, require tailor-made alloys.

Aircraft and automobiles may be considered as the "Tail-Coats" and "Tuxes" of the metallurgical tailors. Nowadays there is likewise a demand for business suits, in the form of high strength alloys to reduce dead load and so increase pay load, all through the transportation industry. We hear most about weight-saving design and materials in respect to the railroads, with the spectacular new high speed passenger trains and the prosaic freight car. The latter sounds especially sweet to steel mill ears because it means tonnage.

While most of us think of these developments, and of the engineering acceptance of high strength materials as "new," the fundamentals are of almost hoary antiquity. It is the widespread availablity of a variety of materials and their general acceptance, that are new.

Reduction of dead load in movable spans and in long spans where most of the required strength is that to support the bridge itself, has long been sought by bridge builders. The steamship designer, too, long long ago realized the advantages of special materials. Today the same basic problem is being tackled by designers not only of railway rolling stock but also of street cars, trucks, busses, and of drag-line buckets, dipper sticks for shovels, gantry cranes and the like. Naturally the requirements vary somewhat.

The metallurgist has to know just what the requirements are before he can concoct an alloy that will meet them. The tailor cannot use the same measurements for a 200-lb. prizefighter and a 125-lb. professor, and the color scheme of the goods required may vary also.

Some of the requirements for different types of service can be set up, at least in general terms. First of these is cost. In choosing materials for chemical construction, when platinum would be the logical choice on the basis of its properties alone, we pass over it unless no other material will show as good service on a dollar basis, and even then, if huge quantities are involved, we pass over it on the basis of first cost. The same principle applies elsewhere. In a steamship, for example, the first cost even of ordinary steel plates is very high. Even though 18 and 8

High-Yield-Strength Structural Steels

By H. W. GILLETT

Chief Technical Adviser, Battelle Memorial Institute

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stainless steel might make a very fine steamship hull, the first cost of 10,000 or 15,000 tons for plates for an ocean liner is too great. Economic considerations as to first cost similarly limit a choice in many other applications. Hopper cars to carry high sulphur coal are being built experimentally of 11 per cent chromium stainless with possible economic justification in view of the attack of the corrosive leachings from the coal, but one doesn't need such construction in a box car in which he is going to ship baled hay. Even for corrosive service one might consider a stainless-clad sheet instead, and very commonly the economics of the case will call for the best corrosion resistance one can get with a fixed, and fairly low, first cost. This cost is usually so low as to eliminate even the "clad" steels.

High Cost Occasionally Justified

In aircraft, and in crack passenger trains, there is economic justification for incurring high first cost, hence aluminum alloys and cold-worked stainless steel, both of high strength-weight ratio, compete with each other, but in service where first cost must be kept down, the choice is more limited. Ragsdale has discussed the differentiation between the needs of high-speed passenger cars and those of freight cars, on the basis of the small proportion of the time the freight cars are in motion. Atterbury, back in 1924, expressed a desire for very cheap aluminum because it would make possible great weight reductions in freight cars. Automobile designers realize that better passenger cars could be made by lavish use of aluminum, if only it were cheap enough to use, as Boyd states. Burgess, in 1923, in a forward-looking article in the preparation of which Merica collaborated, suggested the use of duralumin for bridge construction, a use later accomplished in the repair of the Smithfield bridge in Pittsburgh, under circumstances where a high material cost was justified.

A leader in steel research commented recently that it would be just too bad for the steel industry if the day should come when aluminum alloys were obtainable at say two or three times the cost of steel.

Aluminum alloys, and magnesium alloys as well, have a very distinct field of service. Their low specific gravity allows the use of a much larger cross-section than with steel, and this approximately compensates for the low modulus of elasticity so that an aluminum structure has about the same stiffness as a steel one of equal strength, if the bulkiness of the aluminum allows it to fit into the available space. On the other hand, there are cases where greater hardness is required than is obtainable in the light alloys, for example in riveted structures subject to repeated shock where the rivet holes may stretch and the whole thing get wobbly. In many whole thing get wobbly. In many of the rough-service application for which better materials are sought, rugged qualities are desired all through, and, a ladylike characteristic or two may throw out an otherwise promising material.

Tuckerman has fully discussed the comparative structural properties, for aircraft construction, of the light alloys and the heat-treated or cold-worked alloy steels, on the basis of modulus-density, yield strength-density, and, tensile-strength density ratios, and has pointed out that uniformity of properties from piece to piece, familiarity of the designer with a particular material, and corrosion-resistance are factors in the choice. These factors doubtless account for the 85 per cent aluminum alloys, 15 per cent alloy steel, in the wings, fuselage, etc., of the airplane (exclusive of the engine) given by Johnson and Kennedy as the present ratio.

Without minimizing the value of the light alloys or failing to recognize their competitive position in many special cases, one can certainly say that light alloys alone are not the whole answer to the problem, and that there is a field for heavier materials of low first cost whose strength-weight-dollar ratios are such that they can be used as an economic substitute for ordinary structural steel.

Yield Strength Most Important

In the above the term "strength" is a misnomer, if it be taken to mean tensile strength. It is not high tensile, but high *yield* strength that is sought. In most applications the thing to be guarded against is a crumpling failure, rather than actual rupture. Tuckerman and Stang found that the effective strength of a sturdy structural steel column depends primarily upon the yield strength of the material. Certain limitations in design are necessary in order that this may be broadly true, but structural engineers know, or soon find out, those limitations.

Once it was fully realized that most structures under static stress become useless when they crumple,

even though the failure does not progress to fracture, engineers began to figure on the possibilities in materials of higher yield strength, so that it became established that by the use of a steel of double the yield strength of structural steel, weight savings of one-fourth to one-third are often possible.

The reason why one cannot save half the weight when a double yield strength steel is used is because stiffness has to be maintained. The modulus of elasticity is not appreciably altered in the high yield steels over the ordinary one, nor is the specific gravity greatly changed.

When we substitute a smaller cross-section of a stronger steel for a larger one of a weaker steel we lose stiffness, so tubular construction, stiffening ribs, box girders, lattice construction and the like have to be resorted to. This is perhaps most easily visualized in a steamship. Were the design not altered and were the rib and plate section reduced by the amount the enhanced yield point might appear to justify, the ship would flex and wriggle through the water like an eel, not a very satisfactory mode of motion for a ship.

All applications of high yield steels must therefore be preceded by suitable engineering design, to give the structure the necessary stiffness, for the metallurgist can't do anything at all about altering the modulus of elasticity, and mighty little about altering the specific gravity of steel.

Starting with the general thesis that a weight reduction of one-fourth to one-third is worth the trouble of modifying the design and paying a somewhat higher price in

PHYSICAL AND CHEMICAL PROPERTIES OF AS-ROLLED ¼-IN. BY ¾-IN. PLATE

		Chemical Composition in Per Cent									Yield Strength, Lb. per Sq. In.	Tensile Strength, Lb. per Sq. In.	Elong. in 8 In., Per Cent	Room Temp. Izod Ft.-Lb.	Room Temp. Charpy
		C	Si	Mn	P	Cu	Cr	Ni	Mo	V					
1	Ordnary Structural Cu-Bearing	0.20	...	0.40–0.60	0.04‡	0.20	...	...	...	...	25–30,000	50–60,000	25–30	..	25–35
2	High-Carbon	0.40–0.45	...	0.40–0.60	0.04‡	...	...	...	...	...	45,000	80–90,000	18–20	..	15–20
3	Nickel	0.40–0.45	...	...	...	...	...	3.25–3.50	...	...	50–60,000	85–100,000	18–20	40	..
4	Mayari	0.40	...	...	...	...	0.50–0.75	1.25	...	...	50,000	85,000	19	..	..
5	Ni-Mn	0.30	0.30	1.0	...	...	...	2–2.5	...	...	65,000	100,000	19	..	..
6	Nickel	0.20	0.20	0.60	0.04‡	...	...	2–2.5	...	...	55,000	80,000	20–25	65	..
7	Copper (Lorig)	0.10	...	...	...	1.0	...	...	...	...	55,000	70,000	35*†	..	..
8	Copper (Nehl)	0.12	...	...	...	0.85	...	...	...	...	45–50,000	65–68,000	25	..	..
9	Copper (Brueil)	0.16	...	...	...	1.0	...	...	...	...	59,000	70,000	26	..	..
10	Copper (Hayward & Johnston)	0.38	...	...	...	0.85	...	...	...	...	60,000	70,000	25*	..	..
11	Copper, pptn.-hardened (Smith & Palmer)	0.10	...	...	...	1.0	...	...	...	...	80,000	90,000	28*	..	..
12	Yoloy	0.08	...	...	...	1.0	...	2.0	...	...	55,000	65,000	33*	..	..
		0.22	...	...	...	1.0	...	2.0	...	...	85,000	90–95,000	27*	..	..
		0.24	0.26	0.67	0.05	1.0	...	2.0	...	...	60,000	88,000	27	..	25
13	Hi-Steel (Inland)	0.10	0.15	0.50	0.10	1.0	...	0.50	...	...	55–65,000	75–85,000	22	..	50
14	Alan Wood	0.27	0.01	0.45	0.10	0.45	...	...	...	...	75,000	90,000	14–20	..	..
15	Phos (Hunt)	0.08	0.01	0.48	0.50	...	...	...	...	...	59,000	80,000	23	(Very Low)	..
16	Phos (d'Amico)	0.14	...	...	0.24	...	...	...	...	...	57,000	78,000	22	(Low)	..
17	Cu-P (Lorig & Krause)	0.07	0.02	0.47	0.26	1.4	...	...	...	...	65,000	80,000	27*	..	31
18	Republic†	0.23	...	0.75	...	1.3	...	0.75	0.16	...	70,000	90,000	20*	50	..
	Dbl. Strength	0.08	...	0.70	...	1.4	...	0.75	0.11	...	65,000	74,000	31	76	..
19	G.H.H.	0.12–0.25	0.50‡	1.0–1.3	...	0.35	...	...	0.15–0.25	...	.....	.....	..	..	..
20	Corten	0.10	0.50–1.0	0.10–0.30	0.10–0.20	0.30–0.50	0.50–1.50	...	...	...	50–60,000	65–75,000	23	60	..
21	Chromador (Haigh)	0.26	0.11	0.74	...	0.31	0.93	...	...	...	57,000	92,000	22	..	..
	(Roberts)	0.22	...	0.80	...	0.30	0.90	...	...	...	52,000	85–100,000	17	..	..
22	Union Baustahl	0.15	0.25	0.80	...	0.50–0.60	0.40	...	...	...	.....	.....	..	..	..
		0.12–0.25	0.30–0.50	0.70–1.0	...	0.60–1.0	0.40 0.60	...	...	...	50–60,000	70–85,000	20–25	..	10–15**
		0.19	0.23	0.86	...	0.61	0.43	...	...	...					
23	Cromansil	0.05	0.87	1.12	...	...	0.25	...	...	...	54,000	71,000	31	64	..
		0.14	0.76	1.24	...	††	0.47	...	...	...	62,000	91,000	25	..	..
		0.21	0.72	1.17	...	...	0.47	...	...	...	50,000	92,000	20	36	..
24	Krupp	0.12–0.25	0.30–0.50	1.2–1.6	...	0.30–0.60	...	...	...	...	55–60,000	80–85,000	20–28	..	..
25	Lauchammer	0.12–0.25	0.50–0.70	0.90–1.1	...	0.50–0.60	...	...	...	...	(Meets German specifications for Stahl 52)				
26	Common German Steel 52	0.12–0.25	0.80–1.1	0.75–0.90	...	0.25–0.40	...	...	...	...	(Meets German specifications for Stahl 52)				
27	Manten	0.23	0.23	1.40	...	0.28	...	...	...	...	65–70,000	88–93,000	19–20	..	..
27a	Jalten	0.35–max.	0.30	1.25–1.75	...	0.40–min.	...	...	...	...	50,000	80,000	20	40	..
28	Silten	0.40	0.20–0.30	0.70–0.90	...	0.20	...	...	...	...	45,000	80–95,000	24	..	..
29	Delaware River Bridge	0.34–0.42	0.22–0.24	0.57–0.68	...	...	...	...	...	...	46,500	83–87,000	20–25	..	..
		0.31	0.29	0.96	...	...	...	...	...	...	52,500	90,500	25	..	..
30	Mauretania 1907	0.27	1.12	0.72	...	...	...	...	...	...	62,500–67,000	90,000–105,000	25–30	..	..
31	Recent U. S. Navy	0.18	0.25	1.45	...	0.20	...	...	...	0.18	50,000	80,000	20	..	..
32	Freund (1925)	0.13	1.05	0.57	...	0.18	0.08	...	...	...	56,500	76,000	25	..	..
33	Low C-Mn (Lang 1911)	0.10	0.31	1.27	...	0.15	...	...	...	...	54,500	71,500	28	..	..

*In 2 in.
**Charpy; mkg. per sq. cm.
†Normalized.
††0.50 per cent copper may also be present.
‡‡Molybdenum present, content as needed.
‡Maximum content; this element is usually less than this amount.

first cost and possibly in fabrication cost, to obtain, and that such a weight reduction can be obtained in steels of double the yield strength of structural steel, the problem put to the metallurgist is how best to obtain that one property, yield strength, that the engineer knows he wants and which can be readily determined, quantitatively, along with several other properties also demanded by the engineer, but defined and evaluated in very much less definite and often in only vaguely qualitative fashion.

The language of specifications and test data in which the engineer and the steel maker are trying to talk to each other reminds one of the data one gives when he gets a hunting license — age, weight, height, and color of hair—if any. For the appraisal of a man to be a companion on a hunting trip, one likes to go a bit beyond that, and know whether he is for or against the New Deal, whether he can refrain from shooting at a hen pheasant, and the kind of a poker game he plays. Still others, picking a companion, would want to know what golf score he makes and whether he prefers classical music, jazz, or silence, on the radio. There are a lot of factors that affect the choice of a steel, either from the point of view of the mill that produces it, or the man who uses it. Quantitative evaluation of these factors is very much needed.

Were there no cost limitation and no requirements other than enhanced yield strength it would be very simple to provide steel for the engineer desirous of designing on the basis of high yield strength. Indeed, high yield steels have long been available. That a whole covey of new steels has been flushed in the last couple of years and that scattered birds are still rising, is ample evidence that the older steels were either too costly or not adequate for all the modern uses.

Some of the requirements, aside from yield strength and cost, may be listed as follows: Ability to be fabricated; ability to be welded; toughness; endurance limit; corrosion resistance, and suitability as-rolled.

Properties Are Listed

In the table no attempt is made to evaluate the varieties of low-alloy steels in any fine-haired fashion, only the usual mechanical properties being listed. In this table, a dash is used to indicate a range in content, i.e., steel (1) has a Mn content of 0.40 to 0.60 per cent.

According to Burgess, a high-carbon, high-yield strength steel, No. 2 in the table, was offered as early as 1904. On account of lack of toughness, such steel was not considered satisfactory for many structural purposes. The bridge builders preferred steel with a still higher yield strength and better toughness, so a high carbon steel No. 3 with 3¼ to 3½ per cent nickel added to confer these properties was used, e. g., in the St. Louis bridge. In order to cut the cost, it was sought to reduce the nickel, and steel No. 4 made from Mayari ore and containing less nickel with some chromium, but without dropping the carbon, was used in the Memphis bridge. Later the carbon was dropped a bit, and the manganese raised, as in No. 5, when a very high yield strength was desired. Subsequently, it was found that a still lower carbon with medium nickel, gave a very desirable combination of strength and toughness, as in No. 6, mentioned by Cone. Petersen remarked in a discussion of the development of high-strength, low-alloy steels in Germany that the effort was to match the properties of 3 per cent nickel steel at a lower cost.

The substitution of some nickel by copper, or the use of copper alone, was advocated by Burgess in 1923, since Brueil and Hayward and Johnson had shown the results given in the table as Nos. 9 and 10. (Burgess also suggested using Monel metal as a cheap way of adding nickel and copper, since the ratio in which those elements occur in Monel should be suitable.)

The use of copper in amounts of 0.20 to 0.40 per cent to produce resistance to atmospheric corrosion is old. The value of a larger amount, for use as a strength-giving element, despite the hints in the earlier literature, long went unrecognized. Comprehensive studies of the effect of copper, carried out under the sponsorship of the Copper and Brass Research Association by Lorig and his coworkers at Battelle Memorial Institute and reported in the monograph on Alloys of Iron and Copper and elsewhere led to the realization that even without heat-treatment or precipitation hardening, copper is a strength-giving element.

Some German workers also recognized this and copper, according to some statements, is used in "Union Baustahl" in amount sufficient to give strength, although, according to others, the amount might be below 0.60 per cent. No noteworthy increase in strength is produced till the copper content rises above 0.50 per cent, but above that the increase is marked.

Copper Not Used Alone

Copper is so cheap that its use for the purpose at hand is very logical and, as is shown by steels 7 and 8 in the table, were it feasible to use it alone, a straight copper steel would have the properties desired. The high yield ratio of the copper steels is notable. Smith and Palmer, Nehl, and Lorig and MacLaren all showed that by applying the precipitation hardening treatment of Kinnear to copper steels of say 0.80 to 1.20 per cent Cu, the yield and tensile strengths could each be raised by some 20,000 lb. with retention of much toughness. Of course, the reheating to produce precipitation hardening is not in the picture for the average use of structural steel, though the possibility of enhancing the strength without greatly injuring toughness (especially in the lower carbon steels) is sometimes very valuable.

Copper in amounts sufficient to produce the desired strength is not used all by itself in the modern steels, it is generally accompanied by P or Ni or both because the helpful effect of phosphorus gives strong reason for its addition, and, because when the copper rises much over ½ per cent, it requires very careful control of the soaking pit or reheating furnace to hold the temperature below the melting point of copper. If that temperature is exceeded, preferential oxidation occurs and a film of copper forms beneath the scale, which penetrates the grain boundaries and causes checking of the surface. This has been fully discussed by Gregg and Daniloff. Lorig, and, later, both Nehl and Rädecker showed that the introduction of a minor amount of nickel remedies this condition. Naturally, it is not met when the nickel is present in amount greater than the copper.

Burgess suggested employing a nickel steel, cheapened by the substitution of some copper. This has

(CONCLUDED ON PAGE 51)

Wide Ranges in Single Organization Effort

EQUIPMENTS employed in huge power developments, such as Boulder Dam; for unlimited power applications to production and transportation mechanisms, such as machine tools and electric engines; welding apparatus, for the construction of steel buildings; types of controls and electrical devices, etc., represent only a part of organization activities at the plants of the General Electric Co.

Below are given extracts from a few of the "G. E. releases" during a period of the past few weeks. They serve to further illustrate a breadth of industrial effort such as is not uncommon to some of our larger enterprises. Within such ranges is an undeniable spirit of progressiveness.

• • •

Streamlined Switchboards. — These are of steel with the instruments recessed so that they project about 1 in. from the front of the panel. The new construction is applied not only to vertical switchboards but also to benchboards, cubicle doors, metal-clad front inclosures, and swinging brackets. These new designs have a modern clean-lined appearance harmonizing with smooth walls, clean floors and machines of modern design.

• • •

Metal-Clad Switchgear is extended to light duty service, including central stations, industrial plants, office buildings, etc. Ease of installation, continuity of service and safety are prime factors. Each unit has a stationary and removable element. Included are an oil-blast circuit breaker, instrument transformers, disconnecting devices, supporting structure, interlocking equipment, self-contained elevating mechanism with a removable lever, bus and interconnections.

• • •

Light Duty Outdoor Hook-Operated Disconnecting Switches. — These are designed particularly for rural lines, suburban distribution systems, small industrial sub-stations, and railway signal service. Design provides for either vertical or underhung mounting. A galvanized channel base used with a new switch is provided with slots to make it suitable for pole-top cross arms. Latching in the closed position is assured by a blade latch.

Shipper - Rod - Operated Master Switch performs the function of a two-button momentary contact push-button station. Its magnetic contactor will pick up and seal in, even when the shipper rod is operated rapidly and will drop out and remain unenergized, in the case of voltage failure, whether the rod travel is completed or not. A short time delay between making and breaking the pick-up circuit is employed, so that this circuit will always be broken after it has once been established, regardless of shipper rod position.

• • •

Four New Conduit Grounding Items involve a fixture box having simple and effective method of grounding and providing firm mechanical and electrical connections between the box and the armor. Two of the fittings are equipped with a reversible shackle which fits three sizes of water pipe and allows the conduit hub to meet the pipe at any angle. Connections may be either soldered or solderless.

• • •

Redesigned Air Circuit Breaker. —This device replaces fuses and is designed for the control and protection of industrial circuits, house service entrance, branch circuits, refrigerators, ranges, etc. A "mid-position" of the handle indicates automatic tripping. The position is between "on" and "off." Reclosing of the breaker is easily accomplished by moving the handle to the extreme "off" position.

Low Voltage A.C. Contactor stays closed through voltage disturbances or failure. Instead of mechanical latching, this contactor is closed by a direct-current magnet, energized through a copper-oxide rectifier, and is held closed by the attraction of a permanently magnetized core, and the movable armature. A new alloy, "Alnico" is used for the permanent magnet. It is said to retain its magnetism indefinitely and to exert a force approximately 40 per cent greater than other materials of equal weight.

• • •

High Voltage A.C. Contactor.— The oil blast principle of arc interruption is employed. Utility is in completely oil-immersed motor controllers requiring moderately high interrupting capacity. The contactor is rated 200 amp. at 2200 to 4600 volts, and will interrupt at 50,000 k.v.a. It is latched in, and is tripped mechanically on short circuit by an instantaneous over-current relay. Thermal induction relays give inverse time protection for the motor in the event of sustained overload. Time delay under-voltage protection is also provided.

• • •

Thermal Induction Relay for use in oil immersed motor controllers has tripping characteristics such that difficulty in starting high inertia loads at full voltage is said to be eliminated. A series line-current coil produces a flux in a magnetic core and induces a current in a copper sleeve about this core. Heat from the sleeve is directly conducted and radiated to a bi-metal strip whose deflection causes a set of contacts either to open or to close. The contacts, normally closed, have a slow opening action, preventing too quick tripping on overloads. Carbonization with resulting changes in the characteristic of the relay and sludging of the oil are avoided.

• • •

Combination Magnetic Switches have maximum rating of 25 hp. at

220 volts and 50 hp. at 440 volts to 600 volts parallels. Air circuit breakers, which can be reset by hand after tripping, are used instead of fused safety switches. The breaker operating handle is interlocked with the inclosing case door so that it cannot be opened when the breaker is closed. The breaker can be locked whether open or closed from the outside of the case.

• • •

Fin-Type Calrod Heating Unit.—Employed principally for air heating, where air is forced over the heating units and for such applications as the heating of air conditioned railway cars on electrified lines, building heating and various types of unit heaters. The unit consists of a steel sheath calrod heating element with steel fins, copper brazed to a steel sheath. The copper brazing process provides thermal contact between the fins and the unit sheath and delivers an increased amount of heat in a given space for a given rating.

• • •

High-Speed Relays for Protection of Mercury-Arc Rectifiers.—The induction-cylinder relay is said to have features of design that give a higher torque level for a given size and input, and faster response than previous induction relays. Torque is developed in the same way as it is in an induction-disk watthour meter or relay by inducing eddy currents in an aluminum rotor, but this rotor is in the form of a cup (or cylinder) rather than a flat disk. The arrangement of the eight magnetic poles symmetrically around a central core with the rotor turning in the annular air gap thus formed is suggestive of a small split-phase induction motor, which indeed the induction-cylinder relay is. The central core is fixed to the stator frame; the aluminum cup alone turns. This construction makes the relay very fast.

• • •

Detector for Locating Deeply Laid Pipes.—A magnetic detector of extreme sensitivity and accuracy is said to have located missing pipes up to 100 ft. from their supposed locations, as recorded 40 years ago. The indicator correctly locates to within one diameter of the pipe. The detector is a surveying compass with an adjustable bar magnet for reducing the control effects of the earth's magnetic field. The bar magnet is adjustable for height and azimuth.

Affixed to the compass box and turning with it are two radial fins of high permeability, low hysteresis magnetic material serving as magnetic antennae. These fins effect a substantial increase in sensitivity and are mounted on a crossbar.

The detector is sensitive to iron or steel pipe lines having magnetic bearing, and at a considerable distance away. It may be used with or without electric current through the pipe, although the establishment of a small current makes for easier and more certain search. Non-magnetic pipes obviously require an electric current in conducting a search. Because of its great sensitivity, the instrument cannot be used near trolley lines. It is rarely necessary to work the detector at its extreme sensitivity. Easily manipulated and rapid in results, it will also determine the depth of a pipe within a few per cent.

• • •

Transformer Speed Regulators for Capacitor Motors.—Manually operated transformer speed regulators for high and low torque capacitor motors, with and without full voltage starting for a single-phase and polyphase fan motors, consist of a tapped autotransformer and a snap switch, and for providing full-voltage starting, a relay which affords automatic transfer to the desired running position. With special additions, the regulators are available for reversing service as well as for operation from external sources such as thermostats in an air-conditioning system.

The snap switch provides for three speed positions, and other low speeds may be obtained from the autotransformer through reconnection of the transformer taps to the snap switch, giving a total of seven reduced speeds.

The regulators are for single-phase motors, rated up to 2 hp. and for polyphase motors rated up to 5 hp. The polyphase regulator combines two autotransformers connected in open delta, with a rotating snap switch mounted on a sleeve between the transformer cores. For reversing service, either polyphase or single-phase, an additional snap switch is mounted adjacent to the line switch.

• • •

Electric Thickness Gage, developed for measuring the thickness of porcela in enamel, paint, or other non-magnetic materials such as celluloid, glass, mica, etc., which have been applied to or laid on flat sheets or plates of steel or iron. Quick and convenient measurement of the thickness of the material is permitted not only at the edges but in the middle or any other place where a flat surface slightly more than an inch in diameter can be found. Weighing only 7½ lb. complete, this gage can be used portably wherever a 110-volt, 60-cycle power supply is available.

The new instrument consists of a small indicating unit inclosed in a cast-aluminum cabinet and a ½ lb. gage head connected to the unit by cable. When the face of the gage head is held in contact with the surface of the material to be measured, the thickness can be read directly on an indicating instrument mounted on the front of the cabinet. The gage head can be moved readily to any point on the surface and the corresponding measurement conveniently taken.

• • •

In another field the Foxboro Co. announces several new devices in the control and pressure field.

(1) **The "Vernier Valvactor,"** developed to eliminate valve sticking and to assure hair-line valve positioning through gradual adjustments of the control valve regardless of friction or hysteresis. Where the valve stem packing, for example, must be very tight to prevent leakage, the device assures exact valve response to 1/1000 in. of previous position. The unit, including an air relay, is mounted in a cast aluminum case and is weatherproof. Installation is simple and involves but short interruption to service.

• • •

(2) **An Improved Drive for Control Pyrometers.**—This comprises a ball bearing inclosed motor and a double worm and gear speed reducing system, packed in lubricant. Application is for single controller installations. The new unit provides ample power to operate an additional controller through proper coupling.

• • •

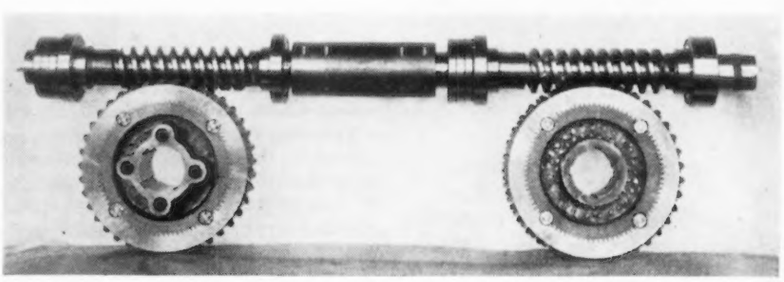
(3) **A New Absolute Pressure Gage** has the pressure measuring and barometric compensation units mounted together, forming a complete, integral actuating movement. Two hydrons, one measuring direct pressure and the other barometric pressure, are so connected that their pressures directly oppose each other. The compensating hydron, which is sealed under full vacuum, exactly counterbalances the barometric effect on the main pressure hydron, and thus enables that hydron to measure only true absolute pressure.

Slidable Work Drum Support for New Drum-Type Milling Machine

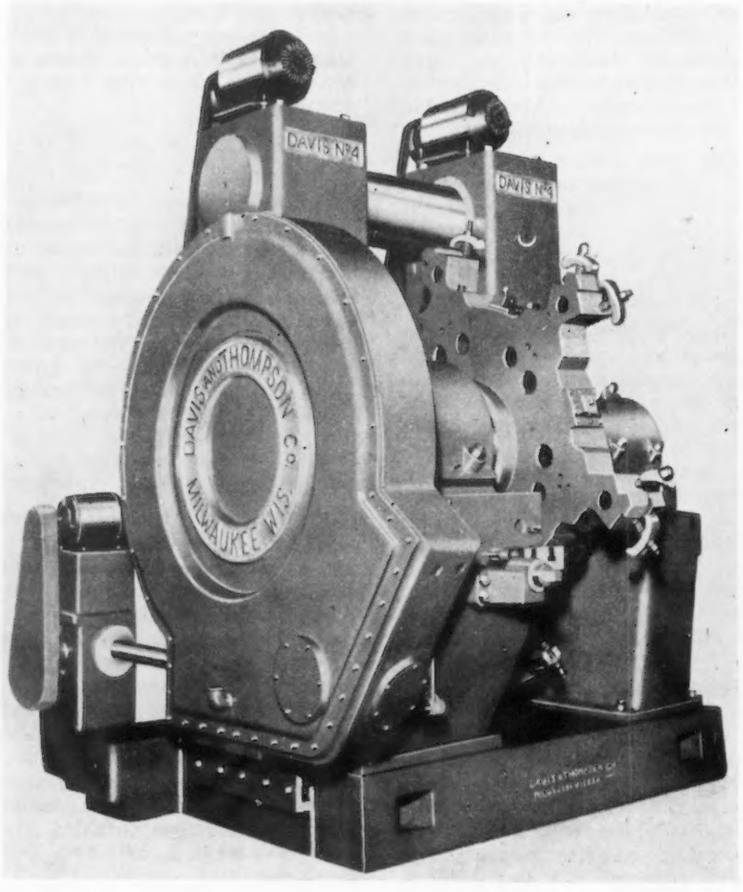
THE overarm support on a new No. 4 drum-type milling machine by Davis & Thompson Co., Milwaukee, is 16 in. in diameter. The left-hand housing supports the roughing and finishing cutters and is bolted solidly to the bed. An extension support for the work drum housing is bolted to this housing and to the bed. The work drum housing, which supports work drum, is slidable on the support for adjustment to work drum spindle in providing any amount of radius within certain limits.

The work mandrel can be changed and brought nearer to the cutters if necessary; therefore the radius from center of work mandrel to center of cutters is changeable. This provision is obtained through design which attaches the worm housing to the slidable portion of the machine.

The right-hand milling head, with its outboard support for outer end of the work mandrel, is adjustable on the machine bed through a large screw on the base of the machine and another screw at the overarm support. This provides adjustability to accommodate variation in lengths of cylinder blocks, for example. The work drum or fixture is located on a work mandrel, 22 in. in diameter, having a 3 in. to the foot taper, and held by a large nut.



SPINDLE bearings are located in sleeves which are fitted to the main frame of this drum-type miller.



The feed is direct by motor to worm gearing. The drive to spindles is through worm and worm gear, as illustrated by the inset—each worm having its own thrust. The lower spindle is adjustable for toe cut and is used for finishing cuts. Spherical bearings are utilized. A geared pump in each head cataracts oil onto work pieces.

The machine weight is approximately 74,000 lbs.

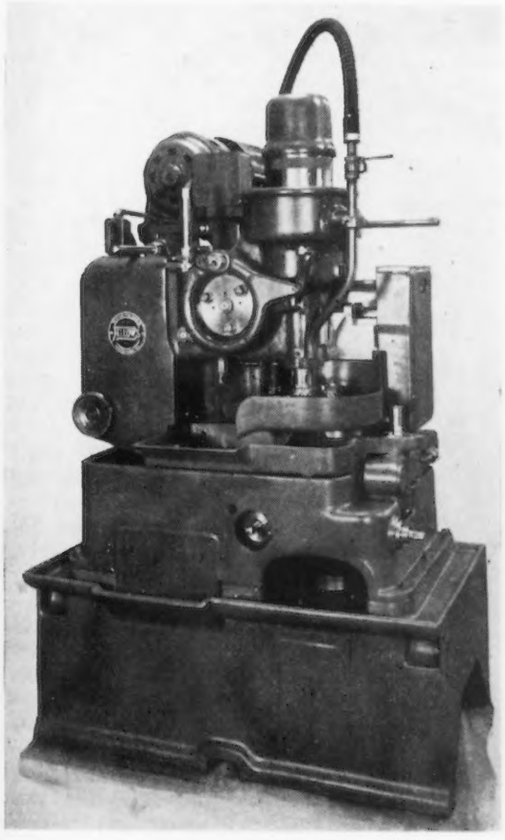
THE South Bend Lathe Works, South Bend, Ind., announces a new V-belt drive as optional equipment on the 1936 model 9-in. precision lathe described in THE IRON AGE, Nov. 28, 1935.

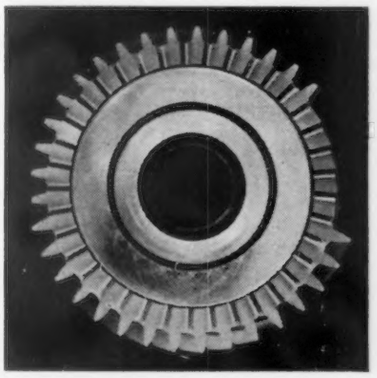
The design provides a single V-belt from an adjustable type counter shaft to a four-step cone headstock; adjustability allows for belt-shifting from step to step.

Special Gear Shaper Completes Rough and Finished Cuts in One Set-up

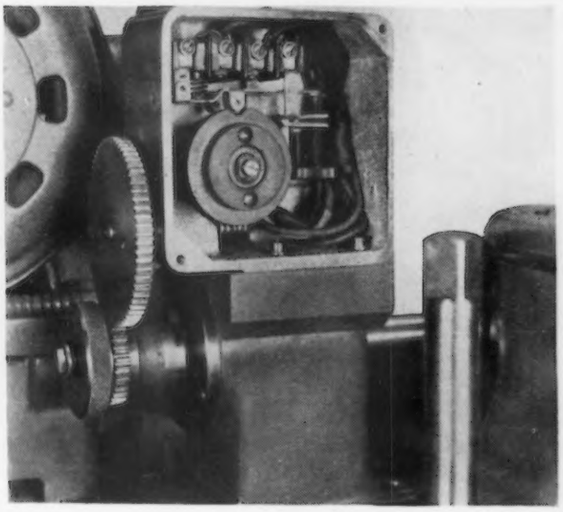
A SPECIAL gear shaper, Fig. 1, particularly designed for use of a new "gap-type" cutter is announced by the Fellows Gear Shaper Co., Springfield, Vt. Specific purpose is for rough and finish cutting of external spur and helical gears in one operation. The cutter is illustrated in Fig. 2, and consists of several arrangements of cutting teeth, involving both roughing and finishing cuts. In principle, this new gap-type cutter differs from the regular gear shaper cutter as follows: (a), a single cutter is used for both roughing and finishing, the cutting being done by separate sets of teeth; (b), the cutter is made with a multiple number of teeth on the work; (c), the cutter is held in a fixed position during the roughing and finishing cuts; and (d), the cutter is rotated into depth, rather than fed in radially. Varying arrangement of teeth provides a wide utility range of work. The cutter illustrated is used for a 16-tooth helical pinion, and is made with one roughing and one finishing set of teeth each. The roughing teeth are shorter and thinner than are those for the finishing cut. With this particular cutter, the work makes two revolutions to one revolution of the cutter, completing the gear in one operation. Cutters may have more than one gap and, of course, the driving gears must have a direct relation to the number of gaps in the cutter, which, for a one-gap cutter, is 2 to 1, while with a two-gap cutter, the relation is 1 to 1, for example.

The machine differs from the conventional gear shaper in that it embodies electrical control for timing the rotation of the cutter spindle. Fig. 3 shows a close-up view of the timing mechanism; a limit switch is geared to the upper worm shaft and is driven by it. The ratio gears rotate the cams that operate the electrical control mechanism. One cam acts to stop the machine, and the other sets up an electrical circuit preparatory to the operation of the "stop" cam. Stop becomes effective when the gap in the cutter is located in the most convenient position to remove and insert work pieces. During the entire cutting operation, both





STOCK removal is divided between roughing and finishing teeth of a single cutter at one setting.



roughing and finishing, the position of the saddle remains unchanged.

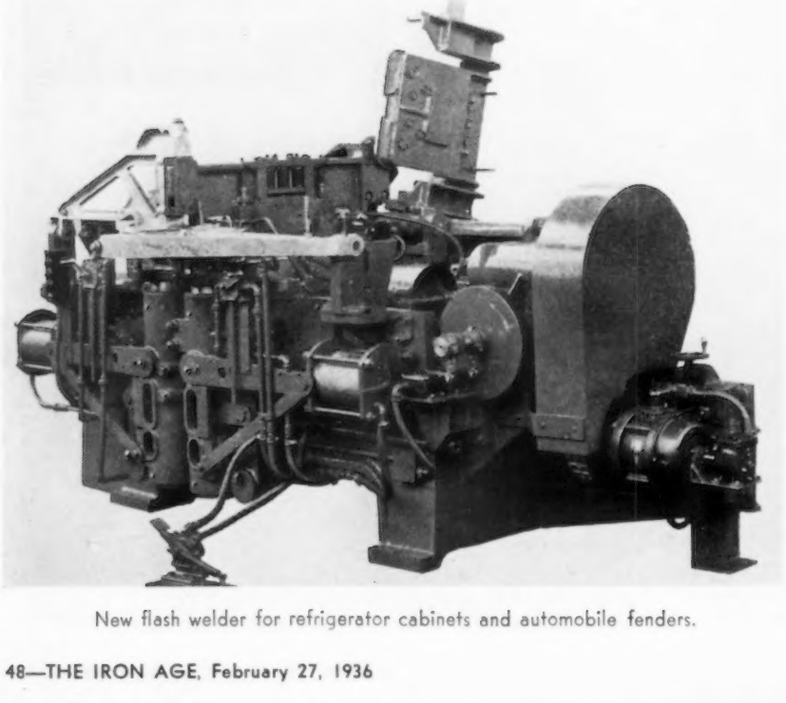
The electrical equipment comprises a constant-speed motor; motor starter with thermal overload protection; interlocking contactors of the make-and-break type; push button control station; automatic stop for use with regular cutters; and cam-operated limit switch. The method of electrical control does not restrict machine utility to the new type of cutter. For the use of standard cutters it is only necessary to remove the driving gear on the upper worm shaft and set the automatic stop control to stop the machine.

Small Flash Welder for Light Gage Work

FOR welding light-gage stampings with assurance of an accuracy of alinement that is necessary if the assembly is to be metal-finished after welding, a small flash welding machine has been brought out by the Federal Machine & Welder Co., Warren, Ohio. It is designed for the resistance welding of such parts as refrigerator cabinets, automobile fenders and other sheet metal parts that require accuracy of alinement and rigidity in clamping, features that are said to have been available only in special-purpose welding machines usually made for handling sheets up to 60 to 70 in. in width used for welding automobile body panels. In other words, it is a small flash welding machine that will do the same kind of work as is done by the largest automobile body welders.

Small flash welding machines, it is pointed out, generally are designed for welding round stock or pipe and do not have the rigidity required to handle 20-gage sheets that may be welded on this machine.

The new machine is a modification of the standard barrel flash welding machine built by the Federal company. It will handle sheets 30 in. wide, as compared with 42 in. wide, the capacity of the barrel welder, and is a 200-kva machine, as compared with the 350-kva rating of the barrel welder. The clamping arrangement has been modified to make it adaptable to the kind of work to be welded.

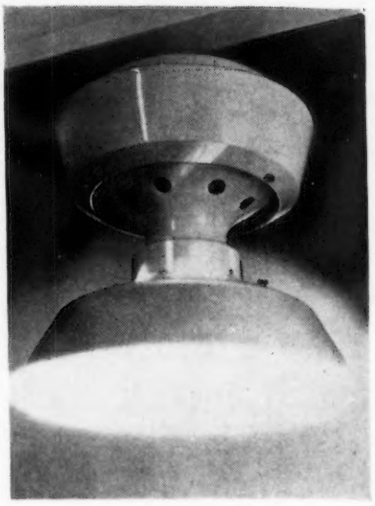


New flash welder for refrigerator cabinets and automobile fenders.

Combination Unit for Industrial Lighting

A SELF-CONTAINED industrial lighting unit with daylight illumination characteristics is announced by the General Electric Vapor Lamp Co., Hoboken, N. J. Specified as "circular mercury-incandescent," the unit consist of a circular mercury-vapor tube and an incandescent lamp combined beneath one reflector to provide the desired spectral balance.

Particular purposes include industrial lighting applications which require accurate color differentiation for critical inspection or for manufacturing operations which present difficult visual problems.



The high blue-and-green emission characteristics of the mercury-vapor tube are blended with the excess red emission common to incandescent lamps in proportions which are said to make for optimum visual characteristics wherever accurate color perception is an important consideration. Because this blending process is adative, the full light value of both tube and lamp is utilized.

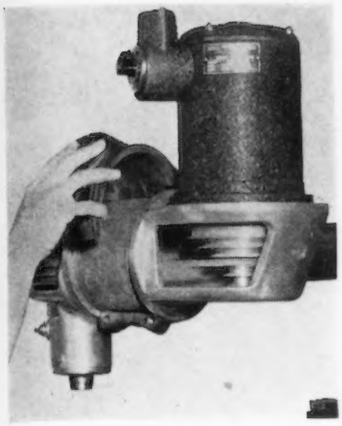
The light unit itself contains the auxiliary for operating the mercury-vapor tube, and is installed and connected to the line in the same manner as the ordinary unit for incandescent light. Both lamp and vapor tube are easily removed for cleaning. Design and finish provide minimum resistance to cleaning and maintenance.

Inclinable Press for Light Stampings

A NEW A-1-¼ inclinable press for light stampings, common to jewelry, toy and similar requirements, is announced by the Niagara Machine & Tool Works, Buffalo.

A 14-point engagement sleeve clutch is equipped with positive stop, locking device and single-stroke mechanism. The slide has equal support for the die from center to front and center to rear, and operates in double "V" adjustable gibs.

Breech block die clamp provides solid support to die under pressure.



Cradle Mounting for End Milling Attachment

A CAST IRON yoke design mounting, having a hinged clamp cover, provides for quick installation of an improved Dalrae Speedmill on a milling machine over arm, as announced by Dalrae Tools Co., Syracuse, N. Y.

New design of the yoke and clamp forms a separately mounted cradle holding the Speedmill unit which consists of a ¼ or 1/3 hp. motor, vertically mounted, at the right of the clamping cradle, and a tool spindle member mounted at the left of the cradle. A 5-step aluminum alloy pulley is carried at the lower end of the motor shaft and a corresponding 5-step solid cast-iron spindle pulley at the upper end of the spindle member. V-belting is used. Four squaring buttons provide for convenient angle setting. Combination collet draw and ejector rod is employed. Six speeds, from 350 to 4000 r.p.m., are available.

Increased Capacities For Molding Equipment

THE Tabor Mfg. Co., Philadelphia, has added to its molding machine line a new 20-in. power jar hand roll, foot draw machine for capacities beyond the company's previous similar equipment.

The ball-bearing guide feature, common to previous equipment, is retained, but each guide is so designed as to be sand-proof and unaffected by dust. Bushings and adjustable gibs have been eliminated. A counter-balance mechanism is spring-actuated and readily adjustable for wide variation in loads. A four-point leveling device has metal core-plate supports with adjustment for wear. Operation is by convenient, quick-acting gate valve. The jarring head and roll-over plate are steel and interconnected to eliminate teetering during jarring, regardless of flask or core-box length.

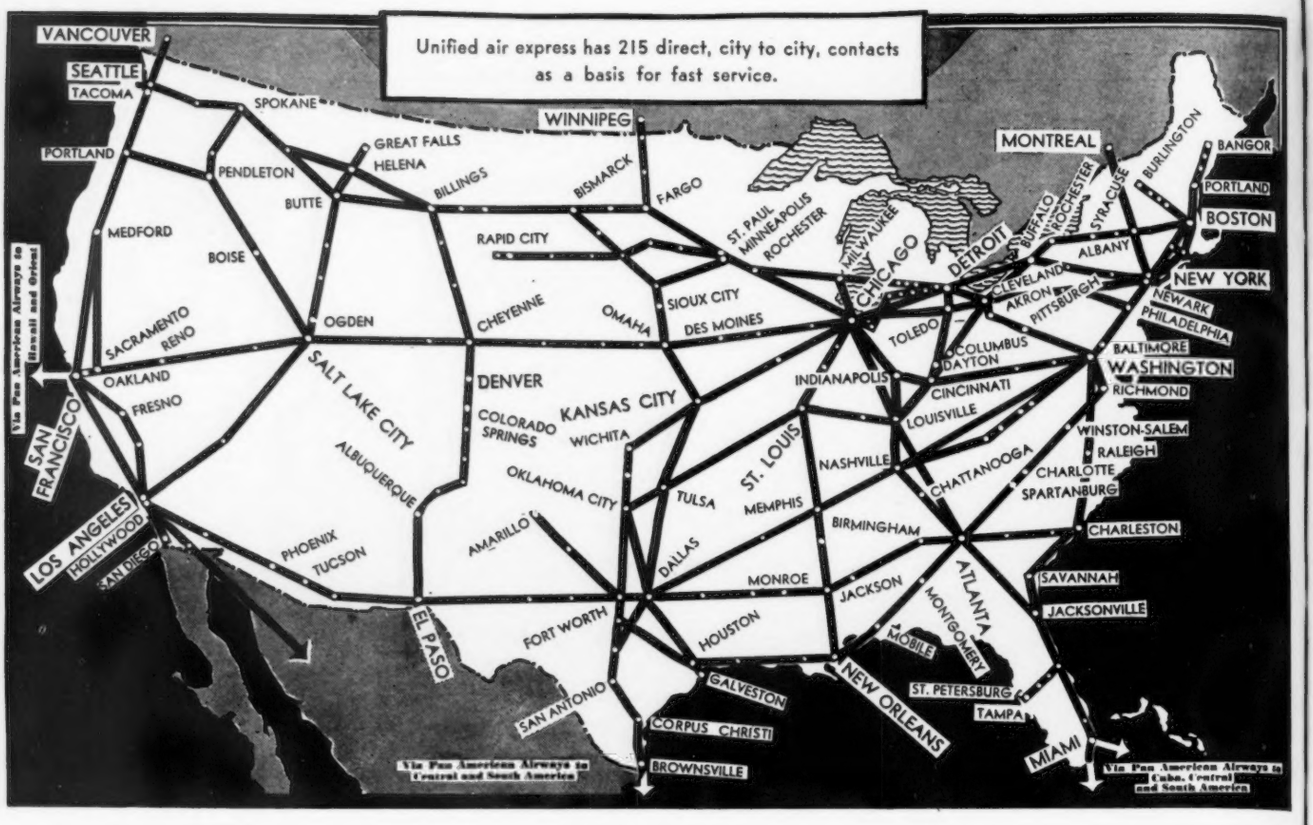
Simplified Equipment For Hand Numbering

A PORTABLE numbering machine by the American Numbering Machine Co., Brooklyn, N. Y., features quick-turning hand adjustment to bring the number desired into correct marking position. Normally, figure wheels are about ⅜ in. above gage plate. After locating the machine on a work piece, the left hand turns the shank member to desired registration; a down pressure positions the wheel against the metal and one sharp hammer blow with the right hand completes the marking. The machine is made entirely of steel; figures are of hardened tool steel. There are no auxiliary parts.

Central Head Control For Lathe Power Units

THE Porter-Cable Machine Co., Syracuse, N. Y., has announced a central control head for the entire electrical and pressure systems for its line of Carbo-lathes.

The device includes starting and stopping buttons for all motors; pressure gages for either air or hydraulic pressure; and direct reading ammeters indicating the amount of power being consumed. This feature includes indication of electrical trouble. The head is said to provide an operator with all necessary information for maintaining proper speeds and feeds to obtain maximum machine efficiency and proper condition of cutting tools.



AN air-delivery service, placing definite centralized responsibility for shipments, has been made available by the Air-Express Division, Railway Express Agency. It provides quick and complete service, including local pick-up and delivery which involves a fleet of 10,000 company-operated motor trucks. Western Union messenger service is also available, without extra charge to the shipper, for the picking up of small shipments for immediate delivery to Railway Express Agency offices. The inauguration of the service is of particular interest to metal-working plants in connection with shipments such as small tools, emergency parts, samples, and in case of breakdowns.

Twenty-three air transport lines are coordinated in the United States and, in addition, there is adjacent territory service by Pan-American Airways. This embraces 32 countries and colonies of South and Central America and the Caribean area. The domestic air network involves 28,300 miles of air routes while that to the south takes in 30,000 miles of long hops. In the United States some 23,000 shipping points are covered by a fleet of 500 airships over a collective total of 146,000 miles of daily flying. Two hundred and fifteen cities in the United States and Canada have direct airport service. Concentrated in the domestic industrial areas reached is a population of over 40,000,000 persons.

This domestic service is operated in connection with 230,000 miles of available rail transport. Just seven years ago the Railway Express Agency entered the air-delivery field in a small way. The new service is in line with the company's slogan—"The Best There Is In Transportation."

Industrial Roof Design for Constant Light and Ventilation

NEW principles in roof design to gain a more even distribution of natural light and to overcome objectionable ventilation, have been employed in the construction of Ford Motor Co., cold finishing mills at Dearborn, Mich. The design is styled as "two-way monitor plan" and involves three monitors lengthwise of the building, one on each side and a larger one in the center. A series of transverse monitors run at right angles to these longitudinal members, from one side to the other, and are attached to and open into the center monitor. Window glass area is in four directions rather than in two. This provides for light regardless of sun position, and is said to prevent the casting of heavy, dark shadows. The monitors, both longitudinal and transverse, contain 108,000 sq. ft. of window sash. The difference in cost because of this huge glass area is negligible. Walkaways, totaling 1½ miles, have been installed about the interiors of the monitors, giving cleaning access to every part of the glass surface. Air is pulled from the lee side of the monitors, either transverse or longitudinal, at all times. Any changing direction of wind currents merely changes the direction of bad air suction; it in no wise impairs the suction and discharge action. If wind currents are diagonal, rather than at right angles, to monitors, both longitudinal and transverse members are effective.

Trends in Low-Alloy Metallurgy

(CONCLUDED FROM PAGE 43)

been done in one of the modern steels, "Yoloy," No. 12-14. The phosphorus may be allowed to run up a bit in this steel, according to the analysis available, but information is not available as to whether this is intentional.

There are other possibilities in the low nickel steels. Greaves reports on steels of higher carbon content than would be considered for our present purpose, in which he seeks to avoid the cost of a high nickel steel by introduction of manganese in such proportion as to avoid overstepping the air-hardening range too far. With normalized steels of about 0.35 per cent C, 1 to 1.2 per cent Mn, 1 to 1.5 per cent Ni, the nickel being held down as the manganese goes up, he found yield and tensile strengths of about 70,000 and 100,000 lb. per sq. in., respectively, 30 per cent elongation in 2 in., 64 per cent reduction of area and 50 to 65 ft.-lb. Izod. Unfortunately, he did not explore the lower carbon ranges, but it would be logical for such a steel to meet our requirements.

"Hi-steel," in which copper predominates, but with sufficient nickel to avoid surface roughness, with the carbon low and the phosphorus high, made by Inland, is being described in a paper at this meeting by Epstein, Nead and Halley. This is No. 13 in the table.

One with copper below the limit requiring nickel, and below the percentage in which it confers much strength, also using phosphorus, but of higher carbon content is "Alan Wood 70-90," No. 14 in the table. The carbon content has to be varied with the section, with so small an alloy content, so it would be classed as a rather high carbon, copper-bearing, high phosphorus steel, rather than among the low alloy steels we are considering.

Phosphorus definitely appears as an alloying element in Inland, Alan Wood, Corten and possibly, to a degree, in Yoloy. There are two very good reasons for its use. Phosphorus by itself really is an alloying and strengthening, and not merely a "nuisance" element. Hunt brought this out in 1885, and as No. 15 of the table shows, there was a high yield-strength commercial steel 50 years ago. A steel with so high a phosphorus content, free from other alloying elements, lacks toughness. In 1913, d'Amico made steel No. 16, which was also not tough enough, though he showed that 0.20 to 0.25 per cent P was the point beyond which toughness fell off almost to zero, but up to which some toughness remained. Lorig and Krause, however, showed that by applying modern methods of grain size control and adding a suitable refining element, such as aluminum, a phosphorus steel of 0.15 C and 0.22 to 0.25 per cent P could be made to show 30 ft.-lb. Charpy. Copper and/or nickel also have a helpful effect. Lorig and Krause give, on ½ in. as-rolled plate, the data of steel No. 17.

The high yield strength and yield ratio of the low carbon, high phosphorus steels are notable.

The Cu-P combination is a good one on the score of corrosion-resistance, as Storey pointed out in 1921 from the early indications of the A.S.T.M. exposure tests. Kendall and Taylerson later elaborated on this, and it was recently again confirmed by Daeves. Just how much better than ordinary copper-bearing steel the Cu-P steels really are has not yet been shown by sufficiently long exposure and service tests.

Some of the proponents of some of the Cu-P steels are staking their reputations as prognosticators by stating that such a steel should show 4, 5 or 6 times the resistance to industrial atmospheres as plain carbon steel and this classes it as distinctly superior to ordinary copper-bearing steel which, according to Speller, has double or treble the life of non-copper steel.

Copper is used as the major strength giving element, along with nickel, to prevent surface checking in Republic "Double Strength," manganese is also kept on the high side, phosphorus is not raised, but 0.10 to 0.20 molybdenum is added. This steel is normalized. Its properties, as given by Miller are shown as steel 18. On the basis of experience with the lower Cu and Mo "Toncan," its proponents expect good weather resistance for "Double Strength." It is stated that the Mo is added to improve the structure on normalizing and to help hold copper in solution, for corrosion resistance.

Editor's Note—In his original paper, Mr. Gillett continued his specific examination of each steel listed in the table, i. e., for steels from No. 19 to 33 inclusive. He points out that Chromador (No. 21) has been on the English market for well over five years and is rather similar to one called "Tiscoten" which is produced by Tata Iron & Steel Co. in India. Likewise, Granite City's manganese high tensile steel falls into the same category as Union Baustahl, but has lower Cu and Cr; also, Konik, made by Continental Steel Corpn. (not shown in table) is being produced primarily for wire and its chemical composition includes a small amount of nickel with very small amounts of copper and chromium. Mr. Gillett also pointed out that a recent Navy specification, steel No. 31, is like Manten with vanadium added. For detailed information about the other steels, obtain Mr. Gillett's complete paper from the A.I.M.E.

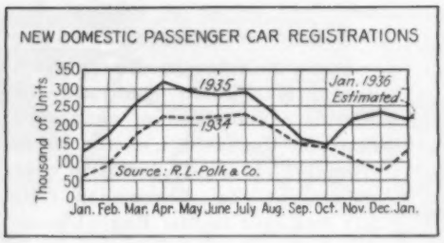
The Railroads and Light-Weight Equipment

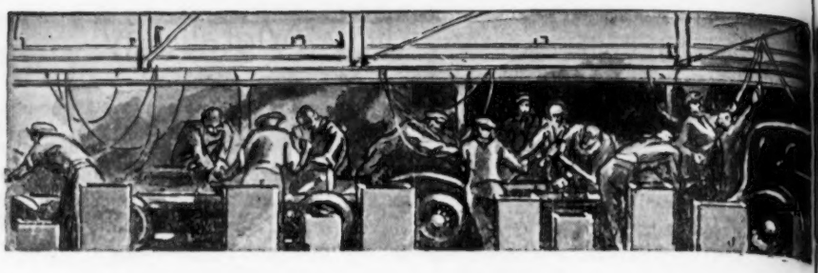
(CONCLUDED FROM PAGE 39)

made are duralumin, stainless steel or various varieties of low-alloy constructional steels.

The great disparity between the pound price of duralumin and stainless steel on the one hand, and of the low tensile steel alloys on the other, must of course be overcome by marked superiority of the former in strength, non-corrosiveness or other properties. But it must not be thought that in the use of these metals the pound prices bear any close relationship to the total cost of the train. As a matter of fact the cost of the metal alloy is in each case only a small percentage of the total cost.

In closing these remarks I think I can say without exaggeration that current development of high-speed trains is making history for the passenger departments of railroads. It comes at a time when the railroads are in greatest need of additional revenues, but also at a time when there are sources from which these additional revenues can be obtained.





A Slow Week Ends a Slow Month As Makers Look to Spring

DETROIT, Feb. 25

THERE has been little change in the weather and therefore little change in the domestic market for automobiles in the U. S. in the past week. Sales of cars are moving very slowly at all points of the line. Buyers who have cars on order are not anxious to accept delivery in the extremely bad weather. Dealers' showrooms and warehouses are stocked to the limit, and factories are using all available space for storage of assembled cars, including vacant real estate in the immediate vicinity of the plant. The automotive industry as a whole has gotten down to the point where it is making only what it can sell. Companies have made valiant attempts to maintain production in order to sustain hours and numbers of workers on the payroll. The first step to meet declining markets was to cut hours and then cut days. This past week saw Detroit operating practically on a three-day week, 7 hr. a day, with the possible exception of the Ford Motor Co., which operated four days. This present week will again see operations carried on for three days only. Even such companies as Buick and Packard, which were running ahead of the pack in terms of per cent of normal operation, are cutting to three days.

As a result, we shall probably see the lowest weekly production for the month of February. Cram's Reports estimated 62,813 units produced for the week ending Feb. 22. With a possible 60,000-unit production for the current week, it will mean that the month will close with a total production of around 270,000 units, a terrific drop from the December high of 421,000 units and the estimated January total of 375,000.

March Looks Better

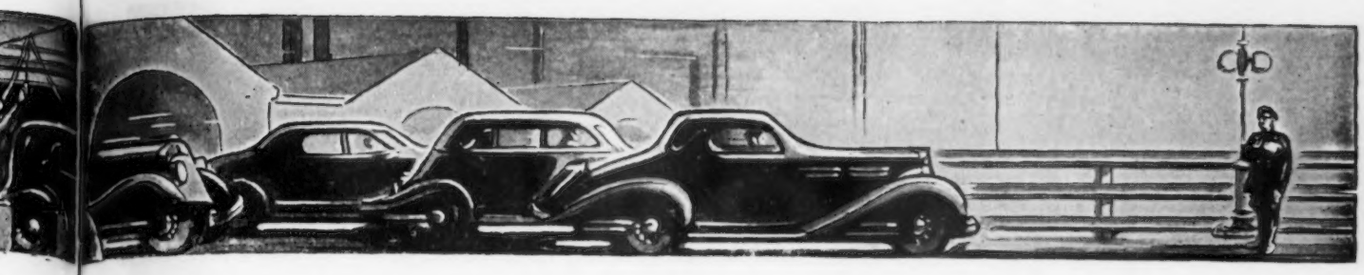
Tentative schedules for the first week in March are based on an expected turn in sales. At the present writing many plants contemplate stepping up to four- and five-day schedules, although, as has been explained in last week's issue, no reliance can be placed on present schedules, as they are subject to almost hourly change.

The problem of shipping cars out of the plants is still a large factor in the present production lull. There has been little improvement in road conditions and shipment by haul-aways has been maintained at an extremely low level. Railroads, as a result, are enjoying an increased amount of business throughout the country but are hampered in automotive shipments by lack of cars equipped with special loading devices. Snow and ice have also kept railroad schedules far behind, and as a result the time it takes for empties to get back to the plants has been greatly increased.

More attention is being paid to the used car than ever before, as it is felt that this is the key to the ice jam in new car sales at present. New methods of merchandising are being introduced, intended to stimulate used car sales over new car sales, and manufacturers are necessarily acquiescing in such a set-up. Ford dealers in Detroit, for example, have on the display floor one new car to five or six used ones. The used cars are in exceedingly clean condition, reconditioned to the extent of even having the upholstery dry-cleaned. Prospective buyers have sometimes failed to distinguish them from late model cars. During the past month one dealer sold 20 such cars off the floor of his display room, while no sales at all were recorded in the outside lot. Despite these heroic efforts, however, used car stocks still remain high (up to 1200 cars per dealer) and it is not expected that any great movement of them will take place until warmer weather sets in.

Steel Releases Are Slow

As a result of continued inactivity in the automotive field, steel suppliers are finding the going very slow. Chevrolet is reported to have placed a fairly sizable tonnage of



ASSEMBLY LINE

By FRANK J. OLIVER
Detroit Editor, The Iron Age

steel, but other makers are holding up older orders, and what releases are coming through are appearing in dribbles. The Ford Motor Co. is holding up on all shipments of raw materials and parts to the plant, indicating a possible oversupply at the present moment. A fair volume of scattered steel buying from other lines is coming in, however, such as to sustain the southern Michigan market at a fairly good level.

Just as steel suppliers were about to agree that it was time to talk up the removal of concessions on automotive sheets, further weakening has been noted in the way of extensions of this type of concession to manufacturers outside the automotive field. We have reference to enameling sheets used by stove and refrigerator manufacturers. Producers agree that prices should be higher and that no particular resistance on the part of the buyer is anticipated at this time, but they are all expecting the other fellow to make the initial suggestion on what will amount to a price increase. In the meantime, the price of raw materials has risen rapidly, particularly scrap.

Evidence continues to pour in as to a large year in machinery purchases and plant expansion. Alfred P. Sloan, Jr., of the General Motors Corpn., in a recent speech at Pontiac, Mich., indicated that the General Motors Corpn. would spend $50,000,000 on plant rehabilitation this year. The announcement of a $6,000,000 program at Grand Rapids was the first gun fired in this campaign, and the latest report is that Oldsmobile will spend a similar amount on a general modernization program at Lansing. Oldsmobile is also to spend $500,000 on a new engineering building. Chevrolet's Flint plant has been an active buyer in the last month and is expected to carry on a large re-equipment program for some time. Some tool room equipment has been bought for the Detroit gear and axle plant and some steam hammers of special design have been ordered for the local forge plant. Proposals being asked on machinery for the transmission plant at Saginaw indicate a probable redesign of the transmission for the 1937 model Chevrolet. It is also expected that Cadillac will be an important buyer in the local machinery market.

Programs are already afoot in connection with 1937 models. During the past week several plants, including Packard, have hired tool and die designers, and there is a brisk demand for pattern makers and model makers at the present time. Except for a small die program for Auburn, there has been little activity as yet in the die shops themselves, although it is expected that this year's program will be larger and longer than the previous one.

Labor Front

The local organized labor situation has become further demoralized in recent weeks. Officials of the A.F. of L. affiliate, the United Automobile Workers, have split into two camps, each occupying part of the same office and maintaining separate communications and payrolls. The chief resentment seems to be against the leadership of Francis J. Dillon, president of the U.A.W. Union, a man placed there by the National Council. The local vice-president and secretary have been trying to drum up a following of their own, and on Sunday addressed a mass meeting of strikers at the Motor Products Corpn. This affair has been dragging on since Nov. 15 with little change in advantage to either side. An interesting sidelight on this situation was indicated recently when a member of the strike committee appeared before the local Relief Commission to ask that the 2100 strikers (out of 2600) who are on relief rolls be *not* certified for W.P.A. jobs. He contended that they should be retained on relief, since assignment to W.P.A. jobs interfered with their picketing. He even intimated that the strikers would seek to cause a strike on W.P.A. projects if they were not put back on direct relief.

Detroit is keeping a close and watchful eye on the Akron situation because of the close tieup of the tire plants with automotive production. U. S. Rubber Company's Detroit tire plant is working at capacity and could not possibly absorb an additional load should a company like Goodyear be definitely out of the picture for any length of time. U. S. Rubber's plant has no organized labor to contend with other than an extremely effective Works Council, and it has enjoyed fine industrial relations for the past several years.

"Roll Your Own" Home

Detroit's distant star gazer, Bill Stout, has been speaking and writing recently of a new arrangement of living based on mobile homes. He predicts that future homes will be made of automotive and aircraft materials, light in weight, quickly movable, air-conditioned, soundproofed and fitted with every convenience. Such roving homes will range in size from the simplest "trailer" cottages for newlyweds to the palatial summer and winter movable palaces of the wealthy.

(CONCLUDED ON PAGE 57)

Rx WE TAKE OUR OWN MEDICINE - and like it

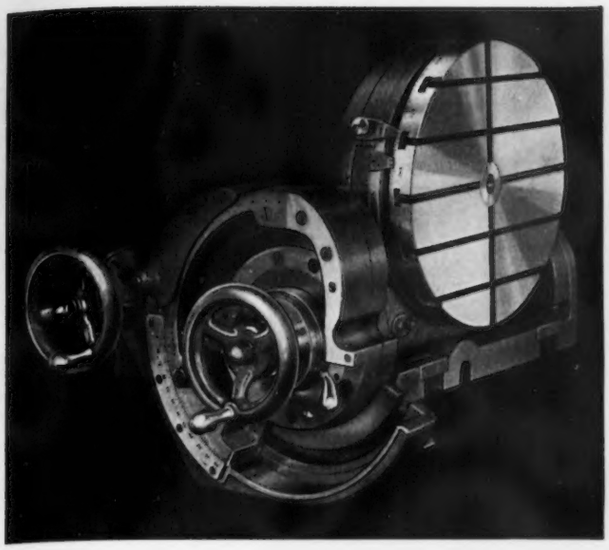
Here is a "nasty" machining problem solved successfully saving $500

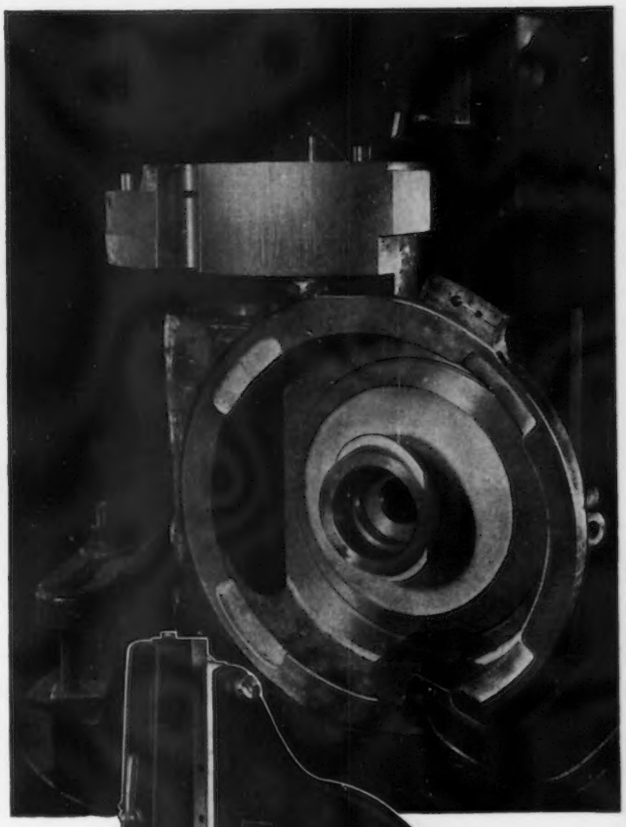
THIS is one of the main castings for the tilting rotary table shown opposite. The cylindrical surfaces indicated by the arrows were necessary for design reasons, and could not be eliminated. The shop *had* to find a way to machine them to specifications. A special fixture to do the job on a planer would have been very costly.

We put this job on one of the three P&W Vertical Shapers in our own toolroom and machined these cylindrical surfaces in one hour per casting, floor to floor time. Only an angle plate and some clamps were necessary. The illustration shows the surfaces just as the Vertical Shaper finished them, and is not retouched.

You can do the same thing in your shop with the P&W Vertical Shaper. Time after time it will do jobs simply and quickly that would otherwise require expensive fixtures. It is literally "the handiest machine in the shop" as hundreds of toolroom foremen will tell you. We can show you many examples where it has paid back its installation cost in short order. It is a profitable investment.

Production profits hinge on precision

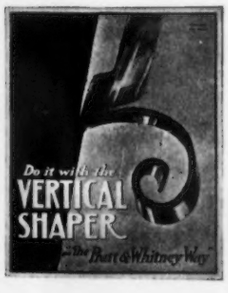




Above is the tilting rotary table for the P&W No. 2A Jig Borer, precision built thruout. The casting shown opposite is one of the main parts of this table. At the right is the casting in place on the P&W 12-inch Vertical Shaper, the machine which finished the difficult cylindrical surfaces so economically. Could your shop, with its present equipment, do this job at the same cost?

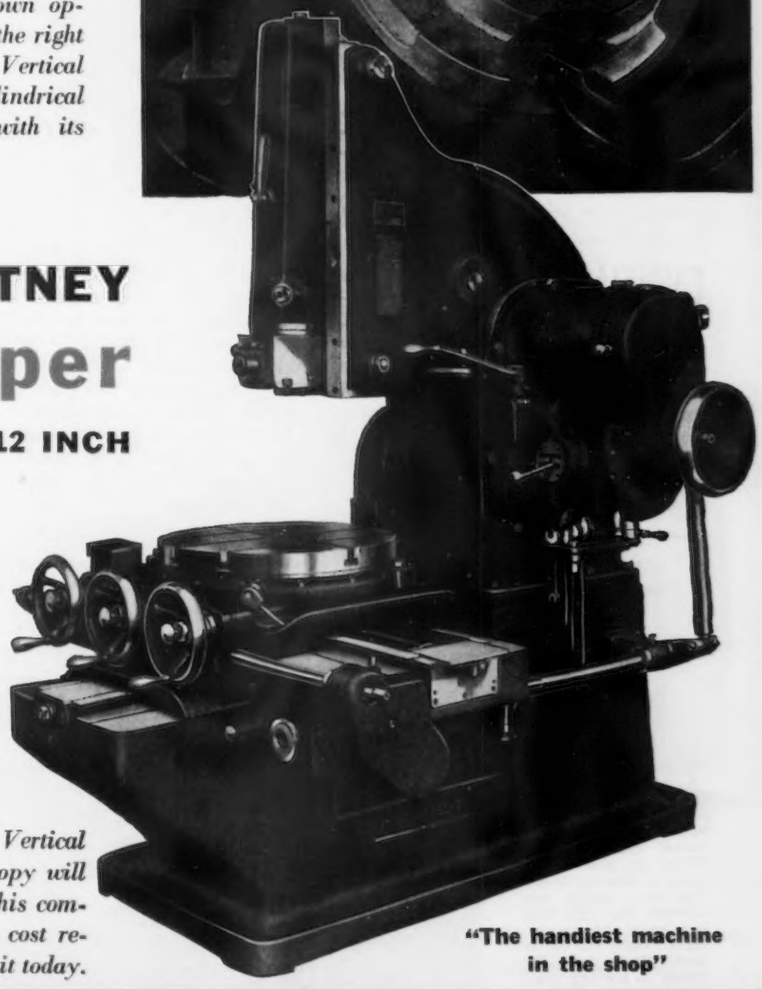
THE PRATT & WHITNEY
Vertical Shaper

6 INCH **12 INCH**



Write for your copy of this

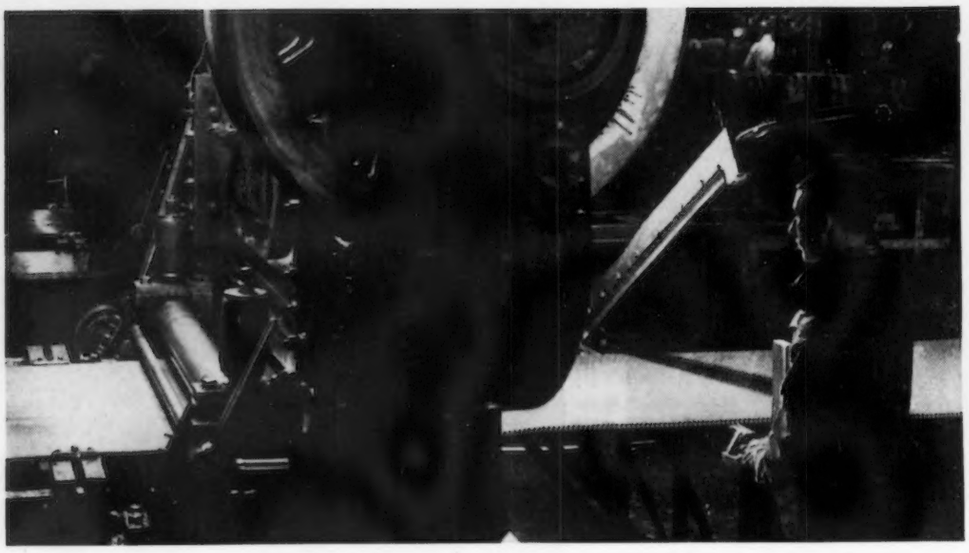
In this book are many jobs which the P&W Vertical Shaper has solved successfully, at a profit. A copy will be mailed to any shop executive requesting it on his company's letterhead. This book may be the key to cost reductions and better work in your shop. Write for it today.



"The handiest machine in the shop"

PRATT & WHITNEY COMPANY
HARTFORD, CONN., U. S. A.

Branch Offices and Agencies: — BIRMINGHAM BOSTON CHICAGO CINCINNATI CLEVELAND DETROIT
LOS ANGELES NEW YORK PHILADELPHIA PITTSBURGH ROCHESTER SAN FRANCISCO ST. LOUIS



FIRST operation in the making of Pontiac's "silver streak" grille. The strip steel, 47⅛ in. wide, comes off a big roll on the left like paper in a newspaper plant and is fed through an automatic press which stamps the pattern of the grille on the metal. As the strip steel with the pattern of the Pontiac radiator grille stamped on it comes through the automatic press, the operator cuts it into workable lengths about eight feet long.

Making Pontiac Radiator Grilles

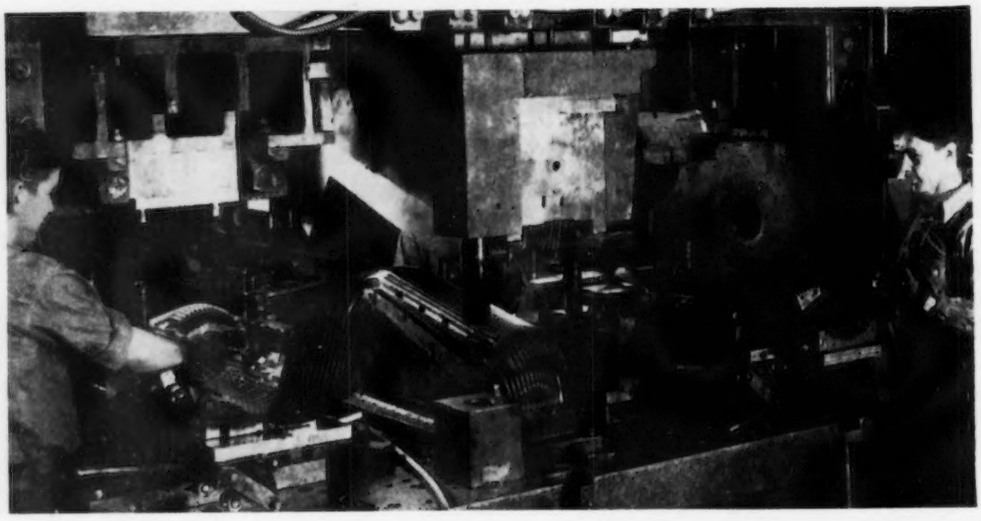
PONTIAC'S distinctive radiator grille design also is a distinctive manufacturing operation. Special press equipment and costly dies are required to produce the latticed front with its graceful curve.

Fourteen general manufacturing operations, with a rather large number of sub-operations, such as the many phases of metal finishing and polishing, are required to turn out the completed grille.

The blank stock comes to the press room in the form of large rolls of strip steel 47⅛ inches wide and about the size of the rolls of paper that are used to print a big city newspaper. This endless strip of steel is fed through the first press, which is automatic in operation. Here the pattern and design of the grille are stamped rapidly into the metal. The operator cuts off stamped strips in workable lengths of about eight feet.

Following this important forming operation, the large sheets are cut into proper widths, the flanges flattened, ends trimmed and flanges bent. These are all separate operations. Then the V-form or surface curve is given the grilles and they are notched for fastening.

Next is the most interesting and probably most intricate metal pressing and die operation in the entire Pontiac sheet metal plant. Five bending and restriking operations are performed in one press. They are, in order: bending the top for the curve over the top of the radi-



THE most intricate die and press operations in the Pontiac sheet metal plant bend and shape the "silver streak" radiator grille. There are five operations in this one press. The flat grilles are clamped into the first position at the extreme right. Here the top is bent. Then the grille comes to the left position in the foreground where the bottom is bent. In both of these operations it is necessary to release the clamps before the dies are withdrawn to protect them from damage. The other three operations are restriking or final shaping.

ator; bending the bottom and three restriking operations which put the finishing touches on the contour of the grille.

So intricate are these bending operations that the clamps which hold the grilles in place in the dies have to be released and opened before the dies can be raised and withdrawn. Otherwise they would be damaged.

After these five press operations there follows the trimming of top and bottom; restriking the top; notching out the crankshaft hole; piercing the fastener holes and then metal finishing and polishing.

Making beautiful but complicated radiator grilles like Pontiac's provides employment for a large number of men who would not have had jobs in the old days when the radiator and its shell stuck out in front like a sore thumb.

This Week on the Assembly Line

(CONCLUDED FROM PAGE 53)

He believes that transportation and the automobile have made this the beginning of a nomadic nation.

Mr. Stout has made good on this prediction to the extent of announcing the Stout Mobile Home, built on a trailer 16 ft. long and 6 ft. 6in. wide, light enough to be drawn behind a passenger car at normal speed. The house opens out to form a living room 20 ft. x 14 ft., supplemented by a galley or kitchen, including a refrigerator, gas stove, hot and cold water tanks, closets, pantry, etc. Six chairs are part of the equipment, four of which are made up into two single beds. When the house is extended it can be divided into two bedrooms and a living room. Either side of the center section folds out for 7 ft. on each side. The structure weighs less than 3000 lb. completely equipped for living. On the road it is supported on two motor car wheels with drop axles and vacuum servo brakes operated from the tow car.

Speaking of homes, another automotive interest is rapidly advancing this field. Kelsey-Hayes Wheel Corpn.'s subsidiary, Stran-Steel Corpn., is supplying more than 75 per cent of new homes constructed with steel frame material. Stran-Steel frames are erected by carpenters working with hammers and nails. A section is made up of two rolled channels with a grooved nailing space in the middle. Steel is supplied by the Great Lakes Steel Co. and is shipped in 250-ft. coils to the Jackson plant of the company, where the steel is rolled, formed and spot-welded.

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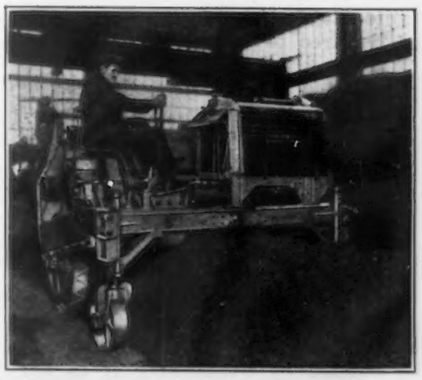

A bibliography of selected readings in books, pamphlets and magazines on the subject of "Foreman Improvement" has recently been issued by the Federal Board for Vocational Education, which is responsible for making studies and investigations and publishing reports designed to aid the states in the organization and operation of efficient vocational education. The purpose of this bulletin is to acquaint those responsible for educational work with foremen and other minor executives with a practical working reference list of material dealing with this subject.

THIS WEEK IN WASHINGTON

Wheeler anti-basing point bill offers serious legislative threat to steel industry.

o o o

Explanation of reasons for bill calls for usual laughs in informed quarters.

o o o

Investigation of technological unemployment by House committee fails to reveal startling facts.

o o o

Old idea of tax on labor-saving machinery is again aired.

o o o

A. F. of L. announces plans for unionization of steel industry; turns down John L. Lewis offer.

o o o

BY L. W. MOFFETT

Resident Washington Editor, The Iron Age

o o o

WASHINGTON, Feb. 25.—The perennial legislative move to abolish the basing point system again has made its appearance. . . . Senator Wheeler, Democrat of Montana, and Representative Utterbach, Democrat, of Iowa, last Thursday introduced identical bills whose purpose is declared to be to eliminate price-fixing schemes, one of which it is charged is the basing system of making quotations. . . . Senator Wheeler, apostle of inflation and silver purchases, is also co-author of the Wheeler-Rayburn bill to extend vastly the powers of the Federal Trade Commission over business by authorizing it to prohibit "deceptive practices." . . . Mr. Utterbach also is sponsoring legislation, as is Senator Wheeler, to broaden the powers of the commission by authorizing it to bar "discriminatory prices" as between large and small buyers, the latter directly aimed against chain stores, though it is so sweeping that many think it, like the Wheeler-Rayburn bill, is so broad that it might be interpreted to encompass a ban against the so-called basing point system. . . .

The "anti-basing point" bill, however, is plainly designed to abolish the basing system with iron and steel, one of the industries particularly in mind, and unquestionably reflects the views of the Federal Trade Commission as is made manifest in reports of the commission on the basing point system. . . . No recognition is given to the fact that the inescapable law of supply and demand has developed some 80 points as the bases of quoting differing iron and steel prices, covering every producing area of the country. . . . The whole subject has been aired repeatedly, yet the singular idea persists in the minds of many, either because it is consciously cultivated or because of resistance to recognition of facts, that there is but one basing point in the iron and steel industry, that, of course, being Pittsburgh. . . . Likewise, the idea prevails that the competitive system does not rule the iron and steel industry, though obviously expansion of the industry and competition inevitably develop new basing points just as more basing point prices become established as further progress requires. . . . The popularity, real or otherwise, of legislative firing at big business, however, is an attraction that cannot be resisted, even at the sacrifice of calling off what has been humorously called the "breathing spell for business." . . . Such a spell, if it ever existed, now is definitely over and has been replaced by the gasping spell. . . .

▼ ▼ ▼

Passage Doubtful

The Senate bill has been referred to the Senate Committee on Interstate Commerce of which Senator Wheeler is chairman. The House bill has been referred to the House Committee on Judiciary, of which Representative Sumners, Democrat, of Texas, is chairman. Both Senator Wheeler and the majority of the committee he heads are known as liberals. Both Representative Sumners and the majority of the committee he heads are known as conservatives. For this reason speculation has it that, probably dependent on White House wishes, the bill may be reported out at the present session by the Senate committee. If it is, it is expected it will be passed. By a like deduction there is doubt that the bill will be reported out at the present session by the House committee. Should it be reported to the House, however, passage would be altogether probable.

Actually, it is purely a matter

of guesswork as to how the bill will fare. If the White House is still favorably disposed to the so-called breathing spell, the assumption is that it would discourage action on the bill, perhaps successfully. Senator Wheeler held a conference with the President on the day following introduction of the bill. It is not known whether the proposed legislation was discussed. Both Senator Wheeler and Representative Utterbach are actively sponsoring legislation directed against so-called "discriminatory pricing." These efforts are directed principally against chain stores.

Senator Wheeler told THE IRON AGE this morning that hearings probably will be held on the bill. He said that those who want to be heard should advise the Committee on Interstate Commerce.

In explaining the anti-basing point bill, Senator Wheeler charged that the practices assailed result in fixed and uniform delivered prices regardless of transportation costs. The bill would compel pricing at points of production and the adding of actual costs of transportation to such costs when delivered prices are quoted. Enumerating what he said are the many results of the systems attacked, he said that "the industrial interests often gain the exclusive benefits of cheap transportation since the basing point systems take into account the freight rates of railroad transportation." He contended that the benefits of cheaper transportation, such as by waterways and highways, do not go to buyers.

"Another result," said the Senator, "is that manufacturers in these industries place their base prices high enough so that they can secure, as witnesses for the steel industry recently stated on the stand, nation-wide distribution. This nation-wide distribution is secured for every plant regardless of its geographic location. Manufacturers ship their products to the distant parts of the country, delivering them beyond the mills and factories of their 'competitors.'"

One of the purposes of the bill set forth in the preamble is "to prevent unnecessary and wasteful cross-hauling."

The Senator's remarks do not take into account the fact that differentials are maintained at the various bases in the steel industry and that the more distant mill in order to reach a market must meet the lowest base quotation. He insisted, however, the system wipes out competition. Even this, he maintained, is not the worst "public evil of these systems." For, he stated, "the scheme tends to fixing constantly increased prices."

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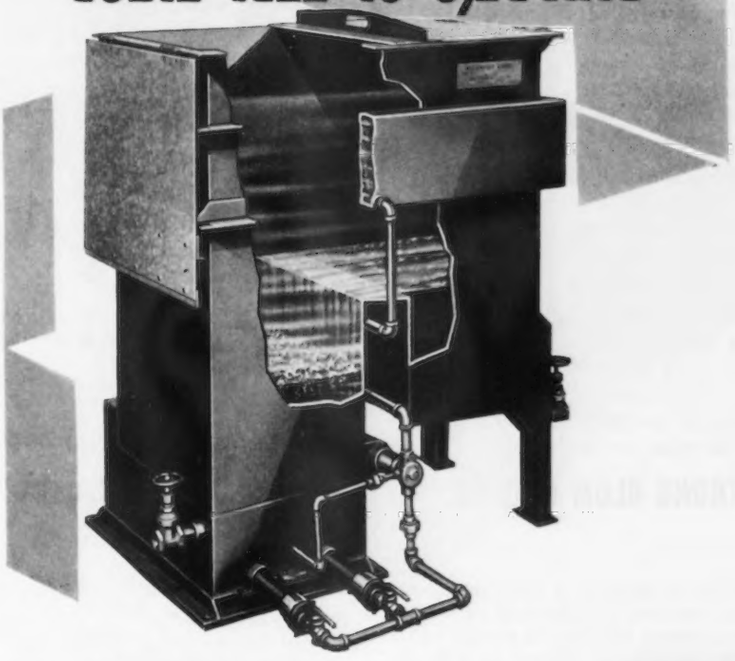

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These schemes are definitely nailed down as one of the major causes of the depression and the Senator urged that lowered prices are necessary to foster "the buyer's comeback" and to put more men to work as a result of renewed buying power.

"In this depression, however," he said, "price-fixing schemes and particularly basing point systems, probably in part induced by the load of fixed debt resulting from integration and mechanization, have so pegged prices of many important commodities, that the usual depression reductions have not prevailed. Accordingly, the purchasing power of the public has been slow in making its upward turn. Instead of price competition bringing back the public to the market and thus setting the idle to work, we still have something like 10,000,000 workers out of jobs.

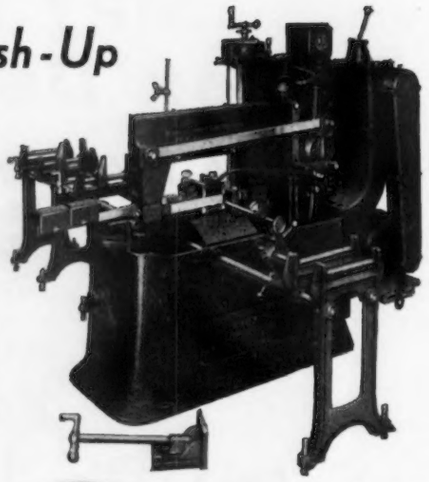
"I have introduced the anti-basing point bill largely for the reason that unless the situation can be

Automatic Bar Push-Up

Automatic in fact, requiring no more attention than an automatic screw machine, the new MARVEL 6A and 9A Production Saws will feed to length and cut-off from solid bar steels (to make gear blanks, for example) 10 pieces 6" round or 160 pieces 1½" round (or other bar sized to 10" x 10" proportionately) every hour floor-to-floor—*Automatically!*

Far heavier, with full ball bearing construction, they will maintain this terrific speed all day, day after day. They cut cutting-off cost to a fraction,—save stock (chip loss) and setting-up time.

These new, far heavier, full ball bearing machines are the culmination of over a quarter century of specialization in the building of automatic sawing machines. They are also available in plain models without automatic bar push-up.



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taken in hand and price competition restored to American business, the country will barely escape from this depression before it will be submerged in another which may be more disastrous than that from which we are now emerging.

"There is no substitute for competitive prices. If each industry is allowed, through basing point systems and other price-fixing devices, to obtain something like a franchise to charge the public what it will, there will be a public upheaval through the stress of high prices and unemployment.

"The public would thereupon insist that the Government police prices to make them reasonable. A representative government is not capable of price fixing and cannot stagger under that burden. If prohibition of the sale of intoxicating liquor proved to be too great a burden, would an effort of the Government to fix prices on bread, steel, clothing and cement and to penalize any lower prices be more successful?

"I believe that this bill should be enacted because I believe it is essential to the future of our economic and political institutions that the anti-trust laws be strengthened and firm steps be taken against price fixing schemes of every kind."

▼ ▼ ▼

House Studies Technological Unemployment

Testifying on the resolution of Representative Palmisano, Democrat, of Maryland, requesting the Secretary of Labor to compile a list of labor-saving devices, A. F. Hinrichs, chief economist, Bureau of Labor Statistics, Department of Labor, recited to a subcommittee of the House Committee on Labor last Thursday the difficult problems surrounding the study of technological developments and their effect on labor.

The study, presented by Mr. Hinrichs in the absence of Isador Lubin, commissioner of labor statistics, who was not in Washington, went carefully into the subject from its various angles. Pointing out that it seems impracticable to compile a comprehensive list of the separate labor saving devices, Mr. Hinrichs said that it is possible to study in detail the factors affecting employment in any one industry or group of related industries.

The resolution is a reflection of other pending legislation, such as that proposing taxation on labor saving machinery, which has back of it the thought that technological developments have displaced labor. Mr. Palmisano told the subcommittee, headed by Representative Lesinski, Democrat, of Michigan, that the data asked for are not for the purpose of retarding improvements but are "for use only in emergency." He added, however, that technological developments make necessary a shorter work week, control of machinery and reduction of the working age limit.

Increased Employment

The testimony of Mr. Hinrichs made clear the difficulty of arriving at arbitary conclusions on the subject and included some outstanding examples of increased employment as the result of technological developments.

"The countless improvements in methods of making vehicles," said Mr. Hinrichs, "including the latest and most efficient mass-production process in the automobile industry, have unquestionably very much reduced the amount of labor required for each unit (as of a given type of automobile). But it does not necessarily follow that the total amount of labor has thereby been reduced. Furthermore, account must be taken not only of the direct labor in automobile factories but of other forms of labor."

Referring to Jerome's "Mechanization of Industry," Mr. Hinrichs told of the four types of labor built around automobile production: That required directly in a particular process; plant labor necessitated by the use of the machine but not engaged directly in its operation; labor applied to the production of the machine itself, or to the production of power, oil or some other commodity used in its operation; and all additional labor required, as for transportation, advertising or merchandising. Mr. Hinrichs said that labor of the first type may be saved by a given machine, while there may be a fairly considerable increase in the other types of employment. Also, it was stated, it is necessary to take into account a possible increase of employment due to such circumstances as the stimulus to road building resulting from the use of automobiles.

"On the other side of the balance sheet it is, of course, necessary to consider the fact that if automobiles had not come into general use," said Mr. Hinrichs, "more labor than at present presumably would have been required in connection with other means of transportation."

What Resolution Calls For

The Palmisano resolution asks the Secretary of Labor to compile a list of labor-saving devices, mechanical and otherwise, put in operation in the United States after Dec. 31, 1912, which are still in use; to estimate the number of persons in the United States now unemployed by reason of the use of each kind or type of such devices and to estimate the number of persons who would be employed

in each of the various divisions of industry, commerce and agriculture, but are not so employed by reason of such devices. Hearings on the resolution will be resumed next Monday.

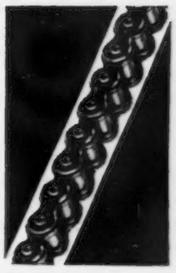
"If we tried to figure the number of men who would be required if it were not for technological improvements to produce goods and services now produced," said Mr. Hinrichs, "the number would exceed the whole population. That, of course, is ridiculous."

Changes which were described by Mr. Hinrichs as mechanical, included the larger and more completely itegrated machines. Examples he gave were the dial or automatic telephone exchange; the Corning bulb machine for making electric-lamp bulbs; the harvester combine; the farm tractor and a belt conveyor system. He also pointed out that there are mechanical changes which are in the nature of modifications or adaptations of existing machines. These were said to be less spectacular in most cases, but, it was stated, they are extremely numerous and their aggregate effect oftentimes much greater than that of the more outstanding changes. Illustrations included: An increase in the size of the steam engine; an increase in the speed of a machine tool due to better materials or fabrications; improvement in one or more of the mechanical parts of an operating unit for the purpose of coordinating the speed of the process on the most efficient basis; improvement in the shape, weight, balance or other characteristics of a plow to increase width of furrow, speed of plowing, etc.

Non-Mechanical Changes

Non-mechanical changes, it was said, are regarded by many students as even more significant in recent years than mechanical changes. It was said that devices or methods which are basically non-mechanical and which have the effect of reducing the amount of labor required per unit of output are also so numerous and varied as to make classification difficult. Among illustrations given were the introduction of scientific management; improved arrangements for lighting, ventilation, etc., with resulting increase in efficiency; better adaptations of workers to their work, based on study of their aptitudes and temperaments; changes in policies regarding employer-worker relations to promote good will or in some other way to increase average output; rearrangement of machinery and equipment for elimination of waste motion and promotion of an uninterrupted, smooth flow of materials or work, discovery and development of new materials, such as petroleum, giving greater

"Can You Break with Tradition?"



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energy per unit of labor involved; tungsten, affording more efficient lighting; and alloys for steel, increasing the usefulness and life of the product.

"Changes which save labor and do not tend significantly to increase total output are likely to be connected with industries with a comparatively inelastic demand," said Mr. Hinrichs. "Thus the harvester combine vastly reduces the amount of labor necessary to harvest a bushel of wheat. Since the demand for wheat is comparatively restricted, the reduced labor cost does not in itself effect a corresponding increase in total output. On the other hand, the invention of the internal combustion engine and other devices necessary for the development of the automobile are more largely significant in bringing about an increase in production of vehicles, because the demand for transportation is far more elastic than the demand for wheat. It is true the automobile has tended to restrict the production of certain other types of vehicles and facilities for transportation, but there has undoubtedly been a very large net increase in total demand for vehicles as the result of the invention of those devices which made possible the modern automobile.

"The utilization of greater efficiencies, such as are involved in labor saving devices, in such way as to increase the total output and to prevent unemployment due to labor-saving devices is bound up with problems of elasticity and of the price system," said Mr. Hinrichs. "The utilization of these economies requires either lower prices or constantly rising incomes."

In addition, it was pointed out, the growth of non-agricultural industries (mining, lumber, manufacturing, construction and the various service industries) has been made possible to a large extent by technological changes.

"These changes," said Mr. Hinrichs, "have reduced the amount of labor required per unit of output but have so increased the total output as to afford much employment to farmers in non-agricultural pursuits. In consequence we have witnessed a comparatively rapid growth of towns and non-agricultural population within recent decades."

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Again the Tax on Machines!

Representative James H. Gildea, Democrat, of Pennsylvania, in a discussion of technological development, has insisted once more that the work week should be shortened and a tax placed on machinery. . . . This is a doctrine of the horse and buggy days if ever there was one and one that if applied would develop a scale of unemployment that by comparison would make the present unemployment, large as it is, look small. . . . Mr. Gildea also volunteered the statement that he is "unqualifiedly in sympathy with many jobless miners in Pennsylvania who are taking millions of tons of anthracite coal from company property without authorization and selling it. . . . That is to say he frankly endorses bootlegging of coal taken from property owners without paying them a cent for it. . . . This suggestion coming from a member of Congress is its own commentary. . . .

Mr. Gildea's observation is cryptic, but, whatever its meaning, it is certain that there is nothing soporiferous about the head of the United Mine Workers. . . . As the leading figure of the Committee for Industrial Organization, John L. Lewis is entirely too alert, active and persistent to suit the Executive Council of the American Federation of Labor, parent body of Mr. Lewis' union. . . . A tortuous hairshirt to the A. F. of L., organized on a craft union basis, the Committee for Industrial Organization, driving for organization on a vertical basis, has heatedly refused to disband at the order of the Executive Council. . . . The latest defi of the committee was in the form of a barbed letter from Mr. Lewis to President William Green of the A. F. of L. last week. . . . Mr. Lewis bluntly informed Mr. Green that the committee would continue to operate. . . . Members of the committee, so the letter said, believed continuance of the committee was "not only fully justified, but essential to the growth of the A. F. of L." . . . The letter poked fun at talk of the Executive Council of a dual labor movement, and the letter was prepared after the committee is said to have discussed plans for industrial organization in the steel and radio industries. . . . The plan for organizing the steel industry has as one highlight a campaign among workers in captive mines. . . . Mr. Lewis is contemptuous of the so-called reorganization plan of the Amalgamated Association of Iron, Steel and Tin Workers, born 76 years ago as the United Sons of Vulcan. . . .

Another plan, though consummately absurd and a cruel hoax perpetrated on naive millions throughout the country, has excited alarm rather than contempt within the ranks of both the Democratic and Republican parties. . . . In order to scotch the fantastic Townsend proposal of $200 per month for pensioners over 60 years of age, the House by a virtually unanimous vote made an oblique attack on the scheme by ordering a "sweeping inquiry" into all proposed old-age pension plans. . . . It can be said that the author of the resolution calling for the investigation who openly attacked the

Townsend plan as a racket has no political fear of it in his district. . . . The sponsor is Representative Bell of Kansas City, Mo., who appears to be one of the few remaining old-fashioned Democrats. . . . It is reported that the committee to investigate old-age pension plans (which is another way of saying the Townsend plan) has a vast amount of evidence to be submitted in putting Townsendites through the hoops.

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Embargo on Tin Plate Scrap Has Repercussions

Enactment of the law embargoing shipments of tin plate scrap was based on the contention that the United States should conserve tin, an emergency metal which is not domestically produced. . . . The law prohibits exportation of such scrap, 60 days after it became effective, Feb. 18, except upon license issued by the President. . . . The President by an executive order has delegated administration of the law to the National Munitions Control Board, of which the Secretary of State is chairman. . . . The other members are the Secretaries of the Treasury, War, Navy and Commerce. . . . Licenses will be granted by Secretary of State Hull by and with the consent of the board. . . . The ban against exportations, according to the act, applies only to tin plate scrap and makes no reference to seconds, menders or waste waste. . . . The great bulk of exports of tin plate scrap has been going to Japan. . . . Prices have mounted to a point where it has been argued the material could not be purchased and detinned profitably by domestic detinning plants. . . . Prices are said to have jumped from $2 a ton to $18 and even $24 at one time, but with the embargo in effect sharp reduction in prices is expected to take place. . . . Exportations of tin plate scrap in 1935 totaled 38,597 tons of which 32,565 tons went to Japan. . . . Outgoing shipments of waste waste last year aggregated 21,927 tons of which 20,669 tons went to Japan. . . . The legislation was sponsored by Senator Barbour of New Jersey and Representative Faddis of Pennsylvania. . . .

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Major Berry's Plans

Voluntary agreements as to wages and hours are looked at askance by Major George L. Berry, industry-coordinator, and the committee on wages and hours of the Major's National Council for Industrial Cooperation. . . . Hence when the council meets early in March (postponed from late February), it is reported the committee will recommend legislation com-

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In the interest of more efficient work and greater safety, you owe it to yourself, to your business associates, and to your employees to be sure that eyes are receiving adequate light for today's close-seeing tasks. This new Light Meter should be in the hands of every business executive.

For further information, telephone or write the nearest General Electric Incandescent Lamp Sales Division office.

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pelling industry to establish fixed hours and wages and it is understood that a 40-hr. week will be suggested. . . . No determination has been reached as to minimum wages but that study, so it was stated, is being continued. . . . Such suggested legislation obviously is another offshoot of pending bills now before Congress, including the 30-hr. week bill, the Walsh government contracts bill and the O'Mahoney bill to license industry, the latter measure requiring collective bargaining which necessarily would involve wages and hours. . . . The committee on National Industrial Policy is said to have adopted a nine-point program providing for active cooperation between industry and government in working out a national industrial policy. . . . One of the points reputedly provides for the plan, heretofore reported, that a permanent Industry-Labor "Legislature" be set up, to be independent of the government, except for funds from the latter for establishing headquarters and a staff to do statistical work. . . . The anti-trust committee of the council is said to be inclined to the view that modification of the anti-trust laws to permit voluntary agreements would not prove satisfactory "as a long-range proposition, but certain "stop gap" legislation might be urged to check "downward spirals" in labor standards, wages, hours, etc. . . . On the much masticated but never digested subject of constitutionality, members of the different committees of the council are represented as being convinced that the issue must be faced "frankly and openly" in order to determine definitely the right of the government to regulate industry. . . . The council is made up equally of management and labor representatives. . . . Industries represented by the council are relatively small, though they entail considerable capital investment. . . . Supporters of the council maintain that it will be continued through contributions from funds of its own members, but since it is at present operated on NRA funds and NRA goes out of existence April 1, there are those who doubt that the council will be continued after that date, despite strenuous arguments to the contrary by its proponents. . . .

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A. F. of L. to Attempt Steel Unionization

The American Federation of Labor will begin a campaign this spring to organize the iron and steel industry. Announcement to this effect was made yesterday by President Green of the federation. He stated that he is working out a budget for the steel campaign which was ordered by the Atlantic City convention of the federation last year.

Mr. Green's announcement was made simultaneously with a decision of the federation to turn down an offer of $500,000 by the industrial union forces to aid in promoting organization in the steel industry. The rejection of the offer accentuated the differences between the industrial and craft union group. The drive to organize mass industries vertically, is being made by a committee for industrial organization representing eight unions. The committee is headed by President John L. Lewis of the United Mine Workers.

The American Federation of Labor is built on a craft union policy. It declined the offer of the committee on industrial organization because it was made contingent on organization along industrial lines. The campaign which Mr. Green says will be started in the spring to organize the steel industry is said to center around a plan of reorganization submitted by the Amalgamated Association of Iron, Steel and Tin Workers.

Mr. Green said that as soon as he completes the budget he will ask every union in the federation, including those in the industrial union committee, to contribute money and organizers "with no strings attached."

Financial Notes

Superior Steel Corpn., Pittsburgh, reports net income for 1935 of $46,691 after Federal taxes, interest, depreciation and other charges, equivalent to 41c. a share on 113,576 shares of capital stock. In 1934 the company suffered net loss of $264,865.

Campbell, Wyant & Cannon Foundry Co., Muskegon Heights, Mich., had net profit in 1935 of $654,002 after depreciation, provision for loss on securities, obsolescence and taxes, equal to $1.90 a share on 343,675 shares of capital stock. This contrasts with net loss of $17,414 in 1934.

Detroit Gray Iron Foundry Co., Detroit, had net profit in 1935 of $72,746 after Federal taxes and charges, equivalent to 72c. a share on 100,000 shares of common stock. In 1934 net profit was $47,474, or 47c. a share.

Eastern Malleable Iron Co., Naugatuck, Conn., declared initial dividend of 50c. a share on its common stock, payable March 20 to holders of record March 10.

Michigan Steel Tube Products Co., Detroit, declared initial dividend of 19c. a share on its new $2.50 par value common stock payable March 10 to holders of record February 29.

Gulf States Steel Co., Birmingham, Ala., declared dividend of $3.50 a share on its 7 per cent preferred, due to accumulations. Payment will be distributed April 1 to stock of record March 16, and thereafter accumulations will amount to $28 a share.

Crucible Steel Co. of America, New York, declared $1 dividend on its 7 per cent preferred on account of accumulations. Dividend is payable March 31 to stock of record March 16. After payment accumulations will equal $25.50 a share.

Jefferson Electric Co., Chicago, has declared an extra dividend of 25c. in addition to the usual disbursement of 50c. a share.

Ross Gear & Tool Co., Lafayette, Ind., reports 1935 net income at $245,771 com-

pared with $248,476 in 1934. Net working capital at the close of 1935 was $920,290 as against $887,061 a year earlier.

Cutler-Hammer, Inc., Milwaukee, Wis., reports 1935 net income of $603,386, compared with $66,454 in 1934. Working capital has increased to $3,168,823 from $2,640,330 at the close of 1934.

Chicago Flexible Shaft Co., Chicago, and its wholly owned subsidiaries in Canada and Australia had 1935 net earnings of $732,535, compared with $368,040 for 1934. Sales of the parent company resulted in a gain of $378,956 in net profit over 1934.

Chicago Railway Equipment Co., Chicago, and subsidiaries had profit for 1935 of $9,011.37 after provisions for depreciation. The 1934 profit was substantially higher.

Continental Can Co., Inc., New York, had net earnings in 1935 of $11,223,578 after deduction of all charges, Federal, State and foreign income taxes and a $500,000 contingency reserve. Earnings, the largest in the company's history, were equivalent to $4.21 a share on 2,665,191 capital shares outstanding, and compare with $10,707,122 netted in 1934, equal to $4.02 a share on identical capitalization.

General Steel Castings Co., Eddystone, Pa., sustained 1935 net loss of $2,510,194 after taxes, depreciation, interest and other charges. This compares with net loss of $1,709,116 in 1934.

Caterpillar Tractor Co., Peoria, Ill., has reported net profit for January of $454,134 after interest, Federal taxes, depreciation, depletion, and other charges. Earnings are equal to 24c. a share on 1,882,240 shares outstanding on Jan. 31.

Baldwin Locomotive Works, Philadelphia, and subsidiaries, including the Midvale Co., suffered net loss last year of $2,119,738, compared with a loss of $3,698,494 in 1934. Sixty-seven per cent of the company's business was outside the locomotive field, compared with 77 per cent for 1934.

American Can Co., New York, had net income in 1935 of $17,310,303, equivalent to $5.83 a share on the common stock. This compares with $19,522,945 in 1934, or $6.72 a share.

McKeesport Tin Plate Co., McKeesport, Pa., earned net profit of $2,135,096 in 1935, which equalled $7.11 a share on the capital stock. In 1934 net profit was $1,859,339, equivalent to $6.19 a share.

Apollo Steel Co., Apollo, Pa., had net income for 1935 of $134,875 after depreciation, depletion and other charges. This figure, equivalent to $1.06 a share on 126,911 shares of capital stock, contrasts with a loss for 1934 of $79,344.

Sullivan Machinery Co., Chicago, suffered net loss of $80,102 in 1935 after taxes and other deductions, compared with net loss of $355,761 in 1934.

Detroit Steel Products Co., Detroit, completed 1935 with net profit of $310,774 after interest, depreciation, Federal taxes, and other charges, equivalent to $1.60 a share on 193,844 shares of capital stock outstanding. This compares with profit of $152,782 in 1934, or 78c. a share on 196,257 shares.

Sun Oil Co., Philadelphia, reports net income for 1935 of $7,100,238 after expenses, depreciation, depletion, etc., equal, after preferred dividend payments, to $3.45 a share on 1,886,594 common shares. The 1935 net was the largest in the company's history with the exception of 1929 and 1930, and compares with $6,650,464 earned in 1934.

Rustless Iron & Steel Corpn., Baltimore, reports for 1935 net profit of $166,133 after charges and taxes, equivalent to 23c. a share on 732,707 capital shares. In 1934 company suffered net loss of $23,033.

Allegheny Steel Co., Brackenridge, Pa., has net profit for 1935 of $1,151,453 after charges, Federal and State taxes, etc., equal, after preferred dividends, to $1.50 a share on 611,095 common shares outstanding. This compares with 1934 net income of $835,927, or 98c. a share on 610,695 common shares. The 1935 profit was the largest in five years, and increased over 1934 by 37 per cent. Tonnage of alloy products produced and sold increased by 36 per cent. Harry E. Sheldon, president, stated that automotive interests substantially increased orders and that purchasing by electrical industries was mounting.

McCord Radiator & Mfg. Co., Detroit, had net profit of $250,680 in 1935 after depreciation, interest, and taxes. Following payment of class A stock dividends, on which accruals total $13.50 a share, the 1935 earnings equalled 72c. a share on 232,746 no par class B shares. Net loss in 1934 was $27,509.

Matching 72 Inches of Hair-Line

From the presses that shaped them come two steel forms. Placed in this Taylor-Winfield Welder, their two edges, each 72″ in contour length, .035″ thin, must be accurately matched for butt welding.

The operator pulls levers—powerful clamps and dies slip into place—two steel faces 72″ long and

"—a fender becomes whole!"

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The entire operation takes less than 45 seconds. The levers are on Ross Operating Valves — seven valves on each welder, controlling air cylinders that actuate slides, dies, clamps. Their performance is swift, clean, positive, economical. They serve a machine that does a job the automotive industry considered impossible.

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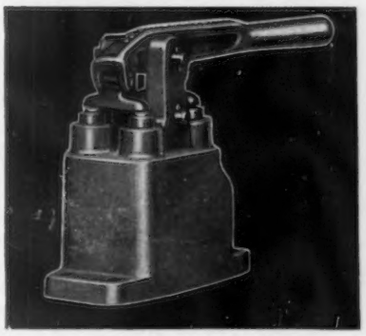
Ross Valves—operated by hand, foot or Solenoid — control single and double acting air cylinders. They are compact. They are simply installed, easily serviced. Employing the poppet principle, they are capable of speedier operation than other types of valves. Flexible discs, seated by air pressure, assure air-tightness over long periods of use—no grinding or lapping is required. To learn more about the



"quick, delicate, sure"

more efficient operation of air cylinders on machinery you use or manufacture for sale, write to the Ross Operating Valve Company, 6488 Epworth Blvd., Detroit, Mich.

NEWS OF THE WEEK

Bethlehem's Pensions At New High

BETHLEHEM STEEL CORPN.'S pension program reached a new high in payment of $840,255 to employees in 1935, according to the annual report of the corporation's general pension board. The pension payment during the past year represented 0.99 per cent of the total payroll. Payments to pensioners since the plan was established in Jan. 1, 1923, have totaled $7,594,796.

The increasing curve of pension payments is accounted for by the fact that in the acquisition of new plants and properties, the corporation recognizes the working record of added employees under prior managements. Thus if an employee has had only five years of service in operations now under Bethlehem ownership, he may nevertheless be eligible for pension because of twenty years of service in the same plant under prior ownership. Bethlehem's acquisitions in the past 15 years have accordingly built up a large roster of new employees including a considerable number of long-service men.

The funds under the Bethlehem pension plan for employees are paid out of the corporation treasury without any contribution by the employees. The plan was adopted to care for long-service workers, and all who have had 25 years of service and are over 65 years of age are eligible. Pensions are also granted for disability after 15 years of service.

Another feature of the Bethlehem plan is that payments are granted as a reward of service and without relation to any relief situation, savings accumulations or other economic recourse of the employees. In many steel plant operations the skill and craftsmanship which come with age are of major importance, with the result that the tendency is to retain employees on the active rolls as long as a man's abilities permit.

Charcoal Furnace Being Dismantled

THE charcoal blast furnace of the Cliffs-Dow Chemical Co., Marquette, Mich., is being dismantled. This furnace formerly operated by the Cleveland-Cliffs Iron Co., having an annual capacity of 36,000 tons, has not been in blast since 1931. It is now owned by the Cliffs-Dow Chemical Co., which was formed some time ago by the Cleveland-Cliffs Iron Co., and Dow Chemical Co. to manufacture chemicals from wood. The Cliffs-Dow Co. finds that charcoal formerly used in the blast furnace has a greater value when used in the chemical field.

Canadian Pig Iron Production Higher

PIG iron production in Canada in 1935 totaled 599,875 gross tons, against 404,996 tons in 1934 and 227,317 tons in 1933, according to final figures released by the Dominion Bureau of Statistics. In addition 8921 tons of pig iron was imported into Canada in 1935 and 13,755 tons were exported.

Stocks of pig iron held by producers Dec. 31, 1935, amounted to 87,346 tons and included 40,897 tons of basic iron; 16,129 tons of foundry iron and 30,320 tons of malleable iron.

Production last year included 468,244 tons of basic iron, 62,294 tons of foundry and 69,337 tons of malleable.

National Acquires One Freighter

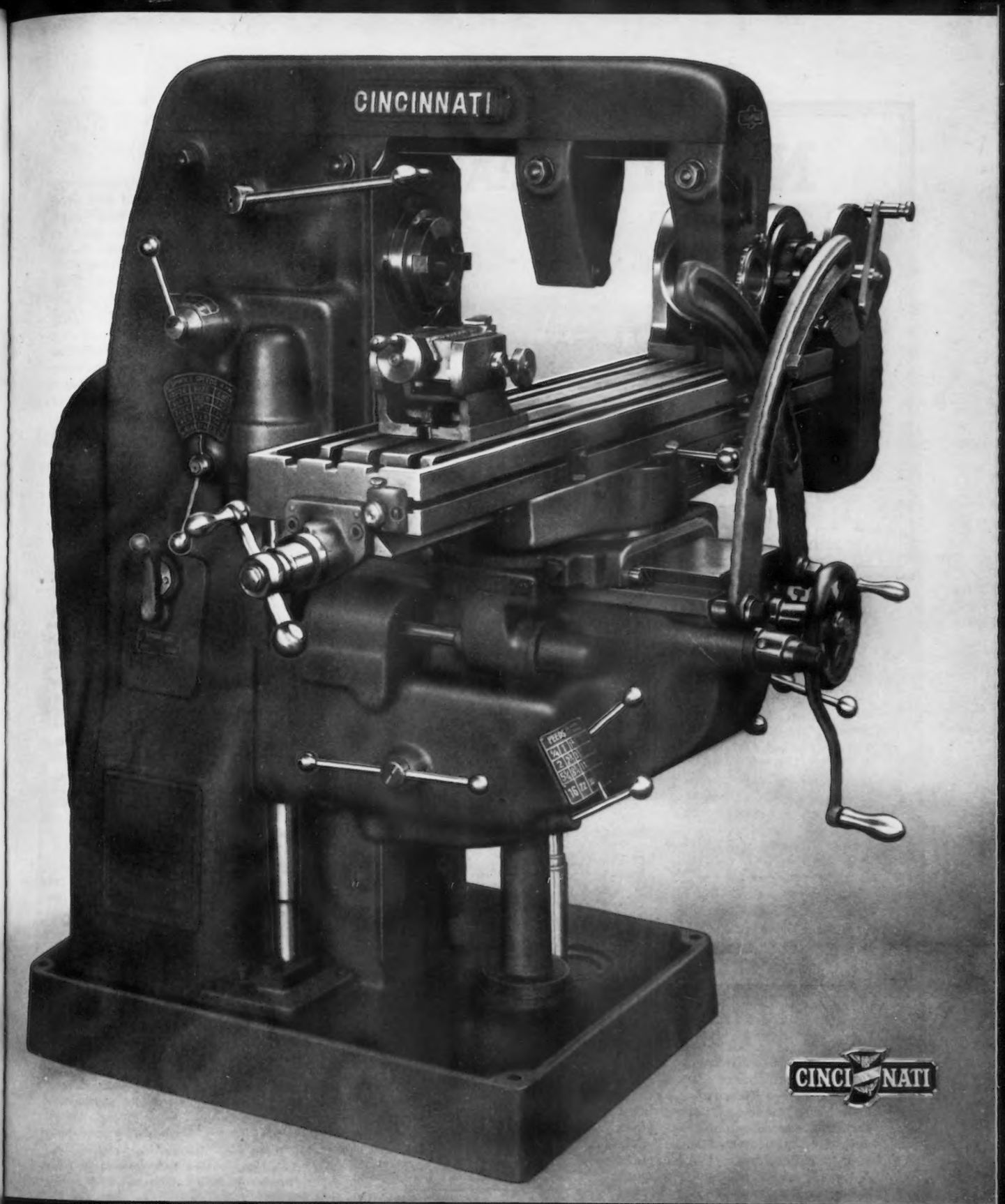
THE National Steel Corpn. has acquired the steamer, *Worrell Clarkson*, a 12,000-ton Great Lakes ore freighter, which will be operated by a National subsidiary, the Producers Steamship Co. Before being placed in service, many additions and improvements will be made to the *Clarkson*, which was purchased from the Kinsman Transit Co., Cleveland. Built in 1923, the freighter has operated in the ore, coal and grain trade. She has an over-all length of 600 ft., a beam of 60 ft., and a depth of 32 ft. The maximum ore-carrying capacity is 13,000 tons.

Cleveland Exhibit to Feature Steel Industry

THE romance of iron and steel will be one of the educational features shown at the Great Lakes Exposition to be held in Cleveland June 27 to Oct. 4. This exhibit, which is being designed by Dr. A. A. Bates, associate professor of metallurgy, Case School of Applied Science, Cleveland, will tell the story of iron from prehistoric times to the present day.

A comprehensive exhibit of consumer goods will be made by the Republic Steel Corpn., which has contracted for a large space. In this exhibit will be shown the steel frame house developed by the Berger Mfg. Co., Canton, Ohio, a Republic subsidiary; and the uses of alloy steels. Sinks, cooking utensils, furniture and other products of stainless steel will show how this steel is finding its way into the home.

Although the exhibit will emphasize the Great Lakes region, companies in other industrial cen-



The New Cincinnati No. 2 Universal L-Type Miller . . .

has all the characteristics necessary for more accurate and profitable tool room and job-lot milling. It is a brand new miller for taking light cuts on the small to medium size work piece. It is designed to afford the operator greater ease and convenience of manipulation . . . it is very adaptable for rapid set-ups. Write for publication No. M-660.

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ters have made space reservations. Companies that have already reserved space include the Timken Roller Bearing Co., International Nickel Co., Youngstown Sheet & Tube Co., John A. Roebling Sons Co., and the following Cleveland companies: Mills Co., and E. F. Hauserman Co., maker of metal partitions, Perfection Stove Co., Cleveland Cooperative Stove Co., Forest City Foundries Co., Superior Die Casting Co., Osborn Mfg. Co., Henry Furnace Co., Standard Tool Co., Grasselli Chemical Co., American Shipbuilding Co. and the Cleveland-Cliffs Iron Co.

Coal and Coke Firms Exchange Facilities

THE H. C. Frick Coke Co. and The National Mining Co., subsidiaries of the United States Steel Corpn., and Pittsburgh Coal Co. have concluded an arrangement for the exchange of coal lands valued at approximately $12,000,000. The Pittsburgh Coal Co. plans to spend about $750,000 for new equipment and to employ 200 to 300 additional miners. The exchange involves about 17,000,000 tons of unmined reserves of the Pittsburgh Coal Co. for a like tonnage of the United States Steel subsidiaries.

The transaction, which entails no cash outlay, affords both organizations access to additional coal supplies without operating new mines. The exchange also will make available 6,000,000 tons of additional coal for mining by the National Mining Co. at Sygan, Pa.

Engineers to Meet With Foundrymen

A JOINT meeting of the Chicago section of the American Society of Mechanical Engineers, the Western Society of Engineers and the Chicago chapter of the American Foundrymen's Association will be held March 16 in the auditorium of the Engineering Building, 205 West Wacker Drive, Chicago. The subject for the meeting will be "Applications of Cast Metals to Engineering Requirements." The principal speakers will be Garnet P. Phillips, International Harvester Co., Chicago, and George Zabel, Fairbanks, Morse & Co., Beloit, Wis. A two-day exhibit of castings, March 16 and March 17, will be held in conjunction with the meeting.

A single order for 227 locomotives to cost $7,500,000 has been placed in England by the London Midland & Scottish Railway. This one order will provide 18 months' work for nearly 2000 extra men. This company during January placed orders amounting to about $15,000,000.

Engineers to Inspect McDonald Mill

AS part of the program of the Association of Iron and Steel Engineers' annual Spring engineering conference to be held at Youngstown, April 22 and 23, an inspection trip to the new hot strip mill of the Carnegie-Illinois Steel Corpn., recently completed and put into operation at McDonald, Ohio, has been arranged.

One thousand or more executives and engineers of the steel industry are expected to visit this new and modern hot strip mill capable of turning out 30,000 tons a month.

Preceding this inspection trip will be an evening and morning technical session, at which will be discussed many important steel making problems of today.

TRADE NOTES

Ohmer Register Co., Dayton, Ohio, has formed Ohmer International, Inc., to handle export activities of company. H. B. Ohmer will be vice-president and director of the new company; R. T. Abrell, sales manager and Edward W. Watts, managing director. Offices are at 115 Broad Street, New York.

Hobart Brothers Co., Troy, Ohio, has appointed J. C. Gowing Welding Equipment and Supply Co., Laura and Regent Streets, Huntingdon Park, Cal., as exclusive distributer for Hobart electric arc welders in Southern California. J. Gowing is manager.

Illinois Testing Laboratories, Inc., Chicago, has appointed Ralph W. Bergen, 328 Chestnut Street, Philadelphia, as representative for Maryland, Delaware, southern New Jersey and eastern Pennsylvania.

H. & H. Tool Mfg. Co., Cincinnati, manufacturer of tools, dies and light stampings, has moved to 412 East Second Street. H. Becker is president.

Michigan Tool Co., Detroit, has appointed R. S. Armstrong and Brothers Co., 676 Marietta Street, Atlanta, Ga., representatives for Alabama, Georgia, South Carolina and southern North Carolina.

Penn Steel Castings Co., Chester, Pa., has opened a New York office at 30 Vesey Street with R. Royal Roane as representative.

Vulcan Wheels, Inc., has been purchased by the American Brake Shoe & Foundry Co., New York. The Vulcan Wheels staff will continue to handle production and sale of Vulcan Wheels products which will become division of parent company.

Detroit Rex Products Co., Detroit, has

moved offices of Eastern sales region to room 630, Bush Terminal Sales Building, 130 West Forty-second Street, New York. D. E. Williard, is in charge.

Whitehead Metal Products Co. of New York, Inc., has leased 5000 additional sq. ft. of office space at 304-314 Hudson Street.

R. S. Armstrong & Brothers Co., 676 Marietta St., Atlanta, Ga., has been appointed representative for Alabama, Georgia, South Carolina and southern North Carolina by the Michigan Tool Co., Detroit, manufacturer of Mitco small tools, including hobs, shaper cutters, special forming tools and Mitco pin splice tools.

Apollo Metal Works, Inc., has moved its general offices and mill from La Salle, Ill., to Sixty-sixth Place and South Oak Park Avenue, Clearing Industrial District, Chicago.

Clarke-Harrison, Inc., announces the opening of an office in the Packard Building, Philadelphia, where services of general management, engineering, sales, organization and operating methods, budgetary control, reflective accounting practice, production control, and product, plant and manufacturing studies will be offered.

New Trade Publications

Flat Rolled Steel. Youngstown Sheet & Tube Co., Youngstown. Booklet of 16 pages, describing and illustrating new continuous hot mill and continuous cold mills of that company at its Campbell, Ohio plant and outlining manufacturing processes from time slabs enter mill until finished steel leaves mill stands.

Box head boilers. Combustion Engineering Co., 200 Madison Avenue, New York. Illustrated catalog, complete with diagrams, describing boiler details and typical installations, including views of shop equipment for annealing and X-raying drums. Diagrams include drawings of 10 different setting arrangements as adapted to various fuels and methods of firing.

Wire Fatigue. Bruntons Ltd., Musselburgh, Scotland. Booklet describing fatigue, how it affects users of wire ropes, and how fatigue tests can be used to insure the best possible properties in wire.

Rubber-Tired Trucks. Lewis-Shepard Co., Watertown, Mass. Illustrated circular devoted to factory and warehouse floor trucks and lift trucks equipped with noiseless, easy rolling, rubber-tired wheels.

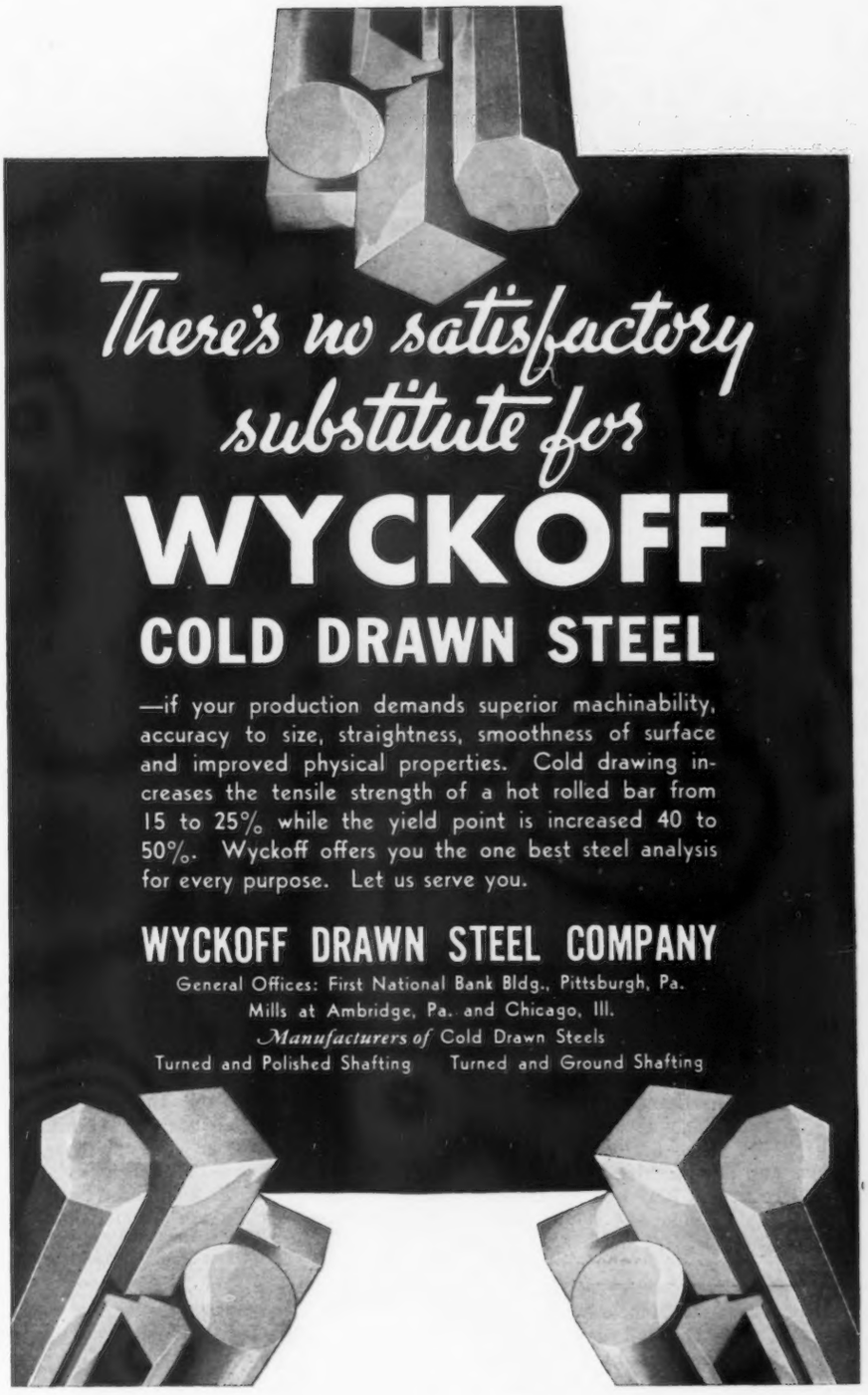
Dust Collectors. American Foundry Equipment Co., 555 Byrkit Street, Mishawaka, Ind. Folder 222 describing and illustrating features of the American Dustube Collector design and listing many of the dusts and materials which may be collected in this system.

Conveyors for Steel Mills. Logan Co., Louisville, Ky. Catalog containing practical information, photographs, sketches and engineering data. Features new heavy duty roller conveyor, coil turnover, tilting section, turn-table, runout tables, apron and live roll conveyors.

Lubrication Systems. Alemite, 1862 Diversey Parkway, Chicago. Catalog, 32 pages of equipment produced for industrial lubrication. Complete information and prices of all Alemite systems—new power guns, hand guns, fittings, automatic oil and grease cups, centralized lubrication equipment, pressure-proof hose and all necessary accessories.

Conveyor Belts. — B. F. Goodrich Co., Akron, Ohio. Contains information concerning the maintenance of a running record of conveyor performance as a means of determining actual belt cost. It also discusses the prolonging of the life of the conveyor belt and includes tables of data.

Electrical Apparatus.—Struthers Dunn, Inc., Philadelphia. Catalogue consisting of 28 pages, dealing with relays, timing devices, thermostats, pots and ladles, resistors, thermal links, insulators, etc. Copy will be sent free upon request.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PERSONALS

HOWARD E. ROBINSON has been elected vice-president in charge of sales of the Otis Steel Co., Cleveland, succeeding PAUL B. ALLEN, who has resigned. Mr. Robinson has spent all his business life in the steel industry. He started in 1910 in the mill of the Allegheny Steel Co. where he remained until 1917 when he enlisted in the army and saw service in France. On his return in 1919 he rejoined the Allegheny company. He joined the Newton Steel Co. at the time of its formation in 1920 and acted as its sales representative in the eastern district with headquarters in New York. During several following years he was in the Detroit and Chicago districts, becoming district sales manager in the latter city. In 1925 he was transferred to the main office of the Newton company at Youngstown as assistant manager of sales and was elected general manager of sales in 1927 and vice-president in 1932. He remained with the Newton company after its merger with the Corrigan, McKinney Steel Co. until June, 1935, when he resigned to join the Otis company as general manager of sales.

Mr. Allen served for 12 years as district sales manager of the Otis Co. at Detroit. In April, 1935, he was made general manager of sales at Cleveland and two months later became vice-president in charge of sales.

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J. E. HURST, president of the Institute of British Foundrymen, has been chosen by that organization as the author of its annual exchange paper to the American Foundrymen's Association. The paper will be presented at the annual convention in Detroit, the week of May 4, and will cover "The Heat Treatment of Cast Iron by Hardening and Tempering."

J. E. HURST

Mr. Hurst is probably the foremost British expert on centrifugal casting and heat treatment of cast iron and is technical director, Bradley & Foster, Ltd., Darlaston, and also of Sheepbridge-Stokes Centrifugal Castings Co., Ltd., Chesterfield, England. He was at one time assistant chemist at the locomotive works of Beyer Peacock & Co., Ltd., Gordon, Manchester, and later became chief chemist and metallurgist, Richard Hornsby & Sons, Ltd., Grantham and Stockport. During the war, he was chief chemist and metallurgist, D. Napier & Sons, Ltd., Acton, London, builder of airplanes and engines, where he organized the research laboratories of that firm.

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H. L. HUGHES, vice-president of the United States Steel Corpn., has been elected treasurer of the American Iron and Steel Institute, succeeding W. J. FILBERT, formerly chairman of the finance committee of the steel corporation, who has resigned.

H. L. HUGHES

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STEPHEN F. BRIGGS, chairman of the board of the Briggs & Stratton Corpn., Milwaukee, has been elected president of the Johnson Motor Co., Waukegan, Ill., manufacturer of outboard engines, the controlling interest in which he recently acquired. He succeeds H. G. DELABAR. Vice-presidents are: JOSEPH RAYNIAK, manufacturing; P. A. TANNER, domestic sales; E. H. MILLET, export and refrigeration. C. P. ROSSBERG is secretary and treasurer. Additional directors are: JOSEPH OTIS, president of the Stewart-Warner Corpn., and EUGENE F. MACDONALD, president,

Zenith Radio Corpn., Chicago, and T. S. MURPHY, Hayden, Stone & Co., New York.

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CHARLES FLEISCH has been appointed assistant superintendent of the Carrie furnaces, Homestead, Pa., steel works, Carnegie-Illinois Steel Corpn., succeeding EDWIN T. WARREN, whose appointment as superintendent of blast furnaces at the Edgar Thomson steel works was recently announced in THE IRON AGE. Mr. Fleisch started with the Carnegie Steel Co., Homestead works, in 1919 in the mechanical engineering department. He was made assistant special engineer in 1924 and was transferred to the Carrie furnaces in 1928. He is a graduate of Carnegie Institute of Technology.

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H. VAN ZANDT has been appointed manager of the newly organized order division, Carnegie-Illinois Steel Corpn., Chicago district. This division is a new unit

H. VAN ZANDT

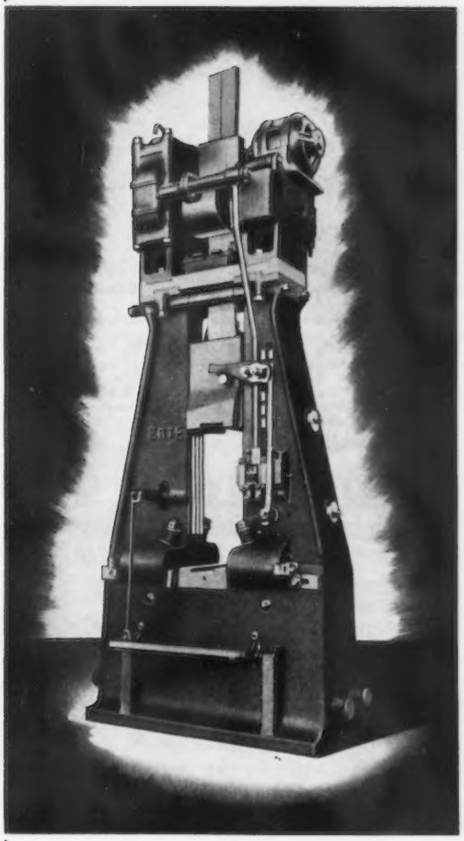
formed by the consolidation of the former order department and sales details functions. Mr. Van Zandt formerly was manager of sales in charge of structural shapes and plates in the Chicago district. He will be assisted by WALTER A. LEVINE as manager of the production bureau, and JAMES M. MOREHOUSE as manager of the service bureau, and will be succeeded as manager of structural plate sales for the Chicago district by FRANK H. LUCAS.

Mr. Van Zandt started in the plate department of the Homestead, Pa., steel works, Carnegie Steel Co., in 1907, and was transferred to the sales department in May of that year. About three years later he was transferred to the Chicago sales office of the Carnegie Steel Co., and in 1919 went to the general office of the Illinois Steel Co. at Chicago. In 1928 he was appointed assistant general manager of sales in charge of the structural division, and last September he was appointed manager of sales, structural and plate division of the Carnegie - Illinois Steel Corpn., Chicago division.

Mr. Levine started with the Illinois Steel Co., Chicago, in 1898. In 1906 he became chief clerk of the billet division, order department; assistant chief clerk of the order department in 1917, and assistant manager order department in 1923.

Mr. Morehouse joined the Illinois Steel Co. in 1909. He served continuously until 1917, when his connection was interrupted by his service in the United States Army during the World War until 1919, when he returned to the company. He was made assistant chief clerk, alloy division, in August of that

The Idea Clicks



Customer acceptance of a new design is really endorsement by a Jury of Critical Experts. A search of the records shows that no hammer has ever "caught on" as quickly as the ERIE Type M. It was the design that the forge shops were waiting for to put production on a modern basis of efficiency and economy.

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OPERATE YOUR TRUCKS CONTINUOUSLY!
Equip them with
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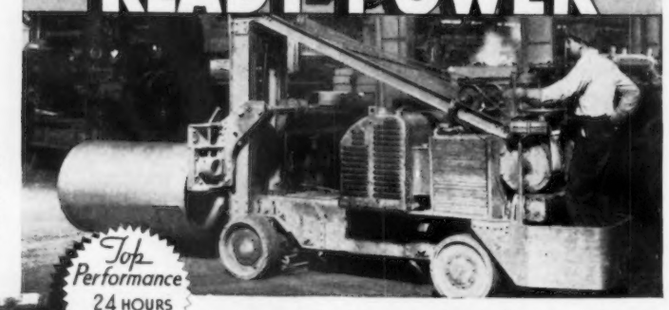

READY-POWER Gas-Electric Drive for Electrical Industrial Trucks.

Top Performance 24 HOURS A DAY

Your Electrical Industrial Trucks will handle 25% to 50% more loads when equipped with READY-POWER, maintaining a steady sustained traveling pace twenty-four hours a day. Many users claim READY-POWER doubled their trucks' materials handling capacity. A 105% sales increase testifies to its merits.

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year, and chief clerk in 1927. Since then he has been chief clerk of the bar division.

Mr. Lucas started with the American Bridge Co., Ambridge, Pa., in 1914. He served as captain in the United States Army in the World War, returning to the American Bridge Co. in 1919 as an inspector. He was transferred to the sales department in 1920, became assistant contracting manager in 1927, and was transferred to the Illinois Steel Co. in 1930 as a structural engineer.

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LESTER B. KNIGHT, JR., vice-president in charge of sales, National Engineering Co., Chicago, has been selected as author of the American Foundrymen's Association's official exchange paper to be presented at the 1936 convention of the Association Technique de Fonderie, the foundry technical association of France, which will be held in Lille next June. Mr. Knight's paper will deal with the more recent developments in sand conditioning and handling.

L. B. KNIGHT, JR.

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C. E. STRYKER, formerly chief engineer of the Fansteel Metallurgical Corpn. and the Vascoloy-Ramet Corpn., North Chicago, Ill., has become associated with McKinsey, Wellington & Co., Chicago, a management engineering firm.

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FRANCIS B. FOLEY, superintendent of research, the Midvale Steel Co., was a guest speaker at the monthly meeting of the Chicago chapter of the American Society for Metals at its Feb. 13 meeting. Mr. Foley's subject was "Steel Alloys for High Temperature Service."

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R. J. SOUTHWELL, who was for many years associated with Wickwire-Spencer Steel Co., is now connected with American Chain Co., Inc., and associate companies, Bridgeport, Conn., in the capacity of sales engineer.

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HAROLD L. HOLTZ, controller of the Sivyer Steel Casting Co., Milwaukee, has been elected a vice-president of the company. WILLIAM F. STREMKE, formerly assistant to the president, has been elected assistant secretary.

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A. E. PERKINS, formerly manager of the Denver office of the Crucible Steel Co. of America, has been made western division manager.

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HARRY C. RITTER, for a number of years associated in a sales capacity with Bliss & Laughlin, Inc.,

C. L. HUFF, who, as announced in these columns last week, has been elected vice-president in charge of sales of the Bliss & Laughlin Co.

has been promoted to the post of district manager of sales in charge of the Chicago district. Prior to his affiliation with the company he was employed in the open-hearth department of the Railway Steel Spring Co.

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R. J. ECKSTEIN, who has been associated with the Cutler-Hammer Co., Milwaukee, for the past 25 years, has been appointed manager of the company's Cleveland office, at 1405 East Sixth Street. He started at the Milwaukee plant and worked through practically every department before going to the Cleveland office.

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WILLIAM TAYLOR, heretofore sales representative in Michigan, Ohio, Indiana and Illinois, for the Toledo Steel Products Co., has been made assistant sales manager. He has been with the company for the past eight years.

❖ ❖ ❖

HARRY B. CLAPP has joined the staff of the Clark Tructractor Co., Battle Creek, Mich., as transporta-

Clark-Sundh
HEAVY DUTY
INDUSTRIAL CONTROL
For Standard and Special drives in all classes of Industry.
Automatic Roller and Catcher Tables for 2-High and 3-High Mills.
Automatic Pre-Set Screwdowns.
Continuous Annealing Furnaces.
Continuous Strip Pickling Process.
Strip Coilers and Uncoilers.
Cut-to-Length Equipment.
Paper Mill Super-Calenders.
Rubber Tire Machines.
Rubber Calender Equipment.
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Knee Action Spring Coilers.
Pair and Pack Furnaces and Conveyors.
Continuous Furnace Lines.
Glass Polishing.
Power Presses with Anti-Repeat Feature.
Hazelett Mills.
Wire Drawing.
Tube Drawing.
Roll Lathes and other Special Machine Tools.
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The above just gives you a fair idea of our activity. We have a complete line of A.C. and D.C. Brakes, Flexible Couplings, Automatic Control for Pumps, Fans and other Building Equipment.
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tion engineer. He will be special engineering assistant to EZRA W. CLARK, vice-president. Mr. Clapp was graduated from the Colorado School of Mines and his business career has embraced production, cost analysis and the elimination of non-productive labor in manufacturing plants.

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WALTER J. MILLER, since 1930 Pittsburgh district manager of sales and production, American Steel Foundries, has resigned to become president and general manager of Keokuk Steel Casting Co., Keokuk, Iowa. OWSLEY BROWN, president, Springfield Boiler Co., Springfield, Ill., and chairman and president of the Koekuk company, retains a substantial interest in the company and is to be first vice-president under the new arrangement, while WALTER O. PARHAM, long associated with Mr. Miller, is second vice-president. EDWARD J. WALSH, who has been works auditor in the Pittsburgh district for American Steel Foundries since 1926, is going to the Keokuk company as secretary and treasurer. Mr. Miller has been engaged in the steel foundry business since shortly after his graduation from the University of Minnesota in 1914. His connection with the American Steel Foundries and that of Mr. Parham began in 1928, when that company acquired the Northwestern Steel & Iron Corpn., Minneapolis, Minn., of which Mr. Miller was president, and Mr. Parham, vice-president.

GEORGE A. SPAULDING, new vice-president in charge of eastern activities of the Bliss & Laughlin Co. His headquarters will be in Buffalo.

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FRANCIS J. LAPOINTE, formerly president of the American Broach & Machine Co., Ann Arbor, Mich., has been named a vice-president of the Sundstrand Machine Tool Co., Rockford, Ill., which has acquired the American Broach Company. D. A. DELONG, heretofore secretary of the Broach company, has been elected assistant treasurer of the Sundstrand company. Other officers are HUGO L. OLSON, president; LEVIN FAUST, vice-president; GEORGE A. LINDBLADE, secretary and treasurer, and GUST H. EKSTROM, assistant secretary and treasurer.

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H. F. HEINEMAN has been placed in charge of sales of Yarnall-Waring Co. products in western Pennsylvania and West Virginia. He will make his headquarters in the Wabash Building, Pittsburgh. EDGAR D. HARDER, with office at 2424 National Bank Building, Detroit, will assist in the sale of Yarway lines in the Ohio-Michigan district.

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Chrome-Vanadium WRENCHES

• Recommended where light weight, greater strength and thinner designs give advantage

In assembly work where light weight increases speed—on automatic machinery where nuts are thin and wrench heads should be—around machinery where longer wrenches are needed and for overhead maintenance work where light weight, added reach and extra strength add to safety, specify ARMSTRONG Chrome-Vanadium WRENCHES.

Longer, lighter, thinner, stronger, chrome-plated with heads ground bright. ARMSTRONG Chrome-Vanadium Wrenches make work faster, easier, safer.

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Rationing of Customers and Suspension Of Exports Necessary in British Shortage

LONDON, Feb. 24 (*By Cable*)—Several blast furnaces have been relit and more are preparing, but the pig iron shortage continues. It is virtually impossible to place orders for early delivery of foundry and basic iron while future business is complicated by anticipation of an early price advance. Consumers have been rationed and export business suspended. Hematite buying has been quiet since the price advance, but consumption is heavy and exports have been curtailed. An east coast firm booked an American order for 1000 tons of Hematite for April delivery.

Additional imports of Continental semi-finished steel are not noticeably relieving the pressure for home supplies. Export trade in finished steel is quiet but home demand of all descriptions of rolled steel is increasing.

Tin plate is good for home bookings. Export business is improved owing to freer distribution of permits, which now, however, are temporarily exhausted. Prices have not advanced despite the rise of five shillings in the home price of spot tinplate bars to five pounds fifteen shillings. Continental iron and steel is satisfactory. Semi-finished steel and ship plates are most active and bars, sections and strip are improved. The best overseas buyers are Argentine and the United States. Good progress has been made toward an international thin sheet cartel.

British Prices, f.o.b. United Kingdom Ports

Per Gross Ton

Ferromanganese, export	£9
Billets, open-hearth	£5 10s. to £5 17s. 6d.
Tin plate, per base box	18s. 9d. to 19s. 3½d.
Steel bars, open-hearth	£7 17½s.
Beams, open-hearth	£7 12½s.
Channels, open-hearth	£7 17½s.
Angles, open-hearth	£7 12½s.
Black sheets, No. 24 gage	£9 15s.
Galvanized sheets, No. 24 gage	£11 15s.

Official Continental Prices, f.o.b. Continental Ports

Per Metric Ton, Gold £

Current dollar equivalent is ascertained by multiplying gold pound price by 124.14 to obtain franc equivalent and then converting at present rate of dollar-franc exchange.

Billets, Thomas.	£2 7s.
Wire rods, No. 5 B.W.G.	£4 10s.
Steel bars, merchant	£3 5s.
Sheet bars	£2 8s.
Plate, ¼ in. and up	£4 6s. 6d.
Plate, 3/16 in. and 5 mm.	£4 8s. 8d.
Sheets, ⅛ in.	£4 9s. 8d.
Beams, Thomas.	£3 2s. 6d.
Angles (Basic)	£3 2s. 6d.
Hoops and strip base	£4 2s. 6d.
Wire, plain, No. 8	£5 7s. 6d.
Wire nails	£5 15s.
Wire, barbed, 4 pt. No. 10 B.W.G.	£8 15s.

OBITUARY

ROBERT W. COUSINS, chief electrical engineer for the last 26 years for the Carnegie-Illinois Steel Corpn. plant at Gary, Ind., died Feb. 18 at Miami, Fla., where he was spending a winter vacation. Mr. Cousins was born in Austin, Texas. He attended a technical school in Cleveland and in 1902 he was employed by the General Electric Co. Several years later he became associated with the old Illinois Steel Co. and was assigned to the South Chicago plant. In 1909 he was promoted to the position of chief electrical engineer at Gary.

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JOHN HUGH MEANS, general superintendent of the Mayville Iron Works, Mayville, Wis., from 1910 until the blast furnace business was liquidated in September, 1927, died at his home in Mayville on Feb. 17, aged 73 years. He was born in South Carolina and for 18 years was connected with the steel industry at Birmingham, Ala., later going to Newfoundland, Pennsylvania and California before becoming associated with the Mayville concern.

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JOHN KENNEDY, president of Hunter Saw & Machine Co., Pittsburgh, died at his home in that city on Feb. 20, aged 73 years.

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CHESTER W. FELL, secretary of the W. A. Case & Son Mfg. Co., Buffalo, died on Feb. 15.

Capital Goods Index Recedes Further

THE downward trend of business activity in the capital goods field, as measured by THE IRON AGE index, has continued, and last week the index, by declining 2½ points, registered its fifth consecutive drop in as many weeks. The hampering influences of adverse climatic conditions upon automobile output were especially severe last week, and, although, as reported by Cram's survey, the low point in spring production is now believed to have been reached, it is a fact that assemblies of cars have been excessively restrained throughout the recent cold period.

A moderate gain in steel ingot production and an improvement in lumber shipments, when taken in conjunction with the normal seasonal change, were insufficient last week to offset the heavily declining automobile factor. Volume of construction work undertaken during the period also showed a recession.

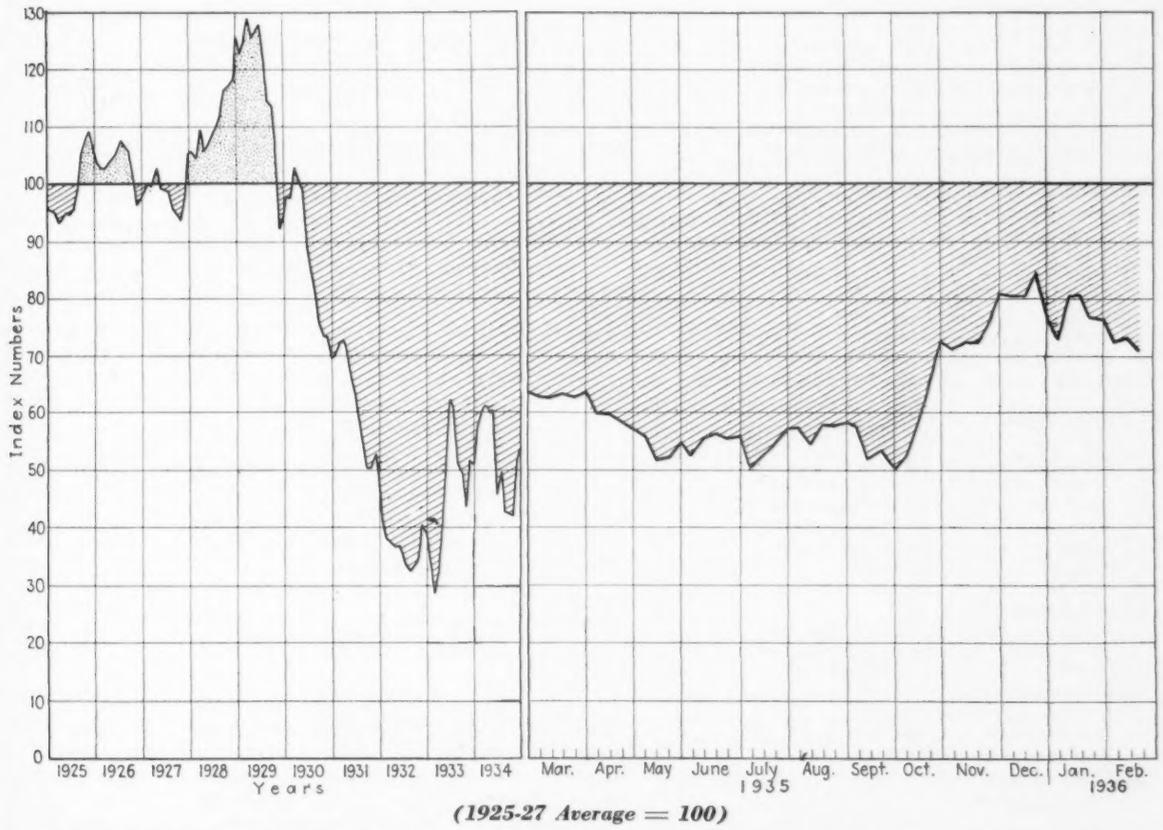
The combined index's present level of 70.9 per cent of "normal" is still substantially above corresponding levels established in 1934 and 1933, but it indicates a loss of approximately 10 points from the year's high to date, recorded in the third week of January.

Despite the failure of industrial operations to expand at this time, the higher level of activity with which the year has opened gives it a distinct advantage over 1935 as compared with that period's comparable showing relative to 1934.

The Iron Age Weekly Index Numbers of Capital Goods Activity

(1925-'27 = 100)

Last week (est.)	70.9
Preceding week (rev.)	73.4
Same week last month	78.7
Same week 1935	61.6
Same week 1934	58.7
Same week 1933	32.5
Same week 1932	40.1
Same week 1931	69.9
Same week 1930	96.4
Same week 1929	122.4



(1925-27 Average = 100)

THE Iron Age Index of Capital Goods Activity. The years 1925 to 1934 are plotted by months, by weeks since 1935.

Components of the index: Steel ingot production rate, from THE IRON AGE; revenue freight carloadings of forest products, from Association of American Railroads; automobile production from Cram's Automotive Reports; heavy construction contract awards, from *Engineering News Record;* index of productive activity in Pittsburgh district, from Bureau of Business Research of University of Pittsburgh.

Current Metal Working Activity Statistically Shown

These Data Are Assembled by The Iron Age from Recognized Sources and Are Changed Regularly as More Recent Figures Are Made Available.

	January, 1936	December, 1935	January, 1935	Year 1934	Year 1935
Raw Materials:					
Lake ore consumption (gross tons)[a]	2,951,568	3,100,530	2,280,393	22,113,951	30,861,473
Coke production (net tons)[b]	.....	3,488,818	2,889,552	31,821,576	35,209,240
Pig Iron:					
Pig iron output—monthly (gross tons)[c]	2,025,885	2,106,453	1,477,336	15,911,188	21,007,802
Pig iron output—daily (gross tons)[c]	65,351	67,950	47,656	43,592	57,556
Castings:					
Malleable castings—production (net tons)[d]	.....	45,598	43,400	369,458	466,395
Malleable castings—orders (net tons)[d]	.....	42,573	44,568	354,146	452,611
Steel castings—production (net tons)[d]	.....	37,793	29,035	450,087	398,988
Steel castings—orders (net tons)[d]	.....	40,529	32,349	434,131	400,157
Steel Ingots:					
Steel ingot production—monthly (gross tons)[e]	3,049,439	3,081,807	2,871,531	25,599,118	33,425,576
Steel ingot production—daily (gross tons)[e]	112,942	123,272	106,353	82,312	107,478
Steel ingot production—per cent of capacity[e]	51.18	55.68	48.04	37.38	48.55
Employment in Steel Industry:					
Total employees[e]	.....	.....	407,071	409,349	.....
Total payrolls (thousands of dollars)[e]	.....	.....	$44,329	$457,848	.....
Average hours worked per week[e]	.....	.....	33.6	30.4	.....
Finished Steel:					
Trackwork shipments (net tons)[e]	3,366	3,025	2,333	49,110	42,229
Steel rail orders (gross tons)[e]	214,541	88,100	51,000	.....	533,120
Sheet steel sales (net tons)[f]	174,805	203,318	321,831	1,830,682	2,473,489
Sheet steel production (net tons)[f]	223,000	208,774	235,714	1,895,460	2,424,990
Fabricated shape orders (net tons)[g]	.....	96,235	64,306	1,054,382	1,068,603
Fabricated shape shipments (net tons)[g]	.....	76,214	89,627	1,116,222	1,095,216
Fabricated plate orders (net tons)[d]	.....	35,584	18,778	241,992	258,315
Reinforcing bar awards (net tons)[e]	67,810	29,025	17,750	182,351	318,340
U. S. Steel Corpn. shipments (tons)[h]	721,414	661,515	534,055	5,925,873	7,371,299
Ohio River steel shipments (net tons)[i]	65,760	61,666	52,656	633,197	925,174
Fabricated Products:					
Automobile production, U. S. and Canada[k]	380,554	421,579	303,392	2,869,963	4,182,591
Construction contracts, 37 Eastern States[l]	$204,792,800	$264,136,500	$99,773,900	$1,543,108,400	$1,844,544,900
Steel barrel shipments (number)[d]	.....	541,375	438,334	6,682,400	6,872,452
Steel furniture shipments (dollars)[d]	.....	$1,558,095	$1,139,497	$11,807,843	$15,523,679
Steel boiler orders (sq. ft.)[d]	623,426	684,735	391,784	4,368,563	6,245,158
Locomotive orders (number)[m]	14	2	0	183	30
Freight car orders (number)[m]	1,050	10,030	24	24,611	18,158
Machine tool index[n]	110.8	98.3	65.5	†46.2	†86.0
Foundry equipment index[o]	127.0	118.1	86.6	†60.5	†103.3
Foreign Trade:					
Total iron and steel imports (gross tons)[p]	.....	93,678	22,784	316,761	469,954
Imports of pig iron (gross tons)[p]	.....	16,289	2,033	115,470	130,937
Imports of all rolled steel (gross tons)[p]	.....	21,812	15,054	113,354	216,567
Total iron and steel exports (gross tons)[p]	.....	239,269	262,740	2,832,764	3,067,336
Exports of all rolled steel (gross tons)[p]	.....	85,590	73,396	951,380	897,749
Exports of finished steel (gross tons)[p]	.....	78,625	66,523	833,559	767,456
Exports of scrap (gross tons)[p]	.....	142,135	179,630	1,835,554	2,047,290
British Production:					
British pig iron production (gross tons)[r]	595,500	559,300	521,200	5,978,500	6,426,000
British steel ingot production (gross tons)[r]	912,500	811,500	757,800	8,859,700	9,842,400
Non-Ferrous Metals:					
Lead production (net tons)[s]	36,296	42,020	29,314	412,298	421,764
Lead shipments (net tons)[s]	34,590	42,333	33,695	378,807	433,456
Zinc production (net tons)[t]	41,826	40,136	35,135	366,933	431,085
Zinc shipments (net tons)[t]	46,468	41,466	35,455	352,663	465,124
Deliveries of tin (gross tons)[v]	6,635	5,360	4,600	46,215	59,110

†Yearly average.

Source of figures: [a] Lake Superior Iron Ore Association; [b] Bureau of Mines; [c] THE IRON AGE; [d] Bureau of the Census; [e] American Iron and Steel Institute; [f] National Association of Flat-Rolled Steel Manufacturers; [g] American Institute of Steel Construction; [h] United States Steel Corpn.; [i] United States Engineer, Pittsburgh; [k] When preliminary, from Automobile Manufacturers Association—Final figures from Bureau of the Census; [l] F. W. Dodge Corpn.; [m] *Railway Age;* [n] National Machine Tool Builders Association; [o] Foundry Equipment Manufacturers Association; [p] Department of Commerce; [r] British Iron and Steel Federation; [s] American Bureau of Metal Statistics; [t] American Zinc Institute, Inc.; [v] New York Commodities Exchange.

Steel Production Rises for Fourth Consecutive Week—Output Now at 55 Per Cent

Continued Price Irregularity, Declining Automobile Production and Bad Weather Are Unable to Check Mill Activity—Scrap Quotations Still Advancing

STEEL production continues to rise this week despite the depressing influences of declining automobile production, price irregularity and unsatisfactory weather conditions. Ingot output is now estimated at 55 per cent of capacity, an increase of 1½ points over last week. Chicago district operations are up three points to 63 per cent, Pittsburgh output is one point higher at 39 per cent and production in the Far West is up 15 points to 60 per cent. Except for minor declines at Buffalo and Cincinnati, operations elsewhere are unchanged.

The remarkable vigor of the industry this month, after a rather faltering January performance, is a source of some bewilderment, even to steel company executives. However, raw steel output in February normally anticipates active spring demand and this factor is still important despite temporarily bearish influences such as weather conditions and price weakness. Also the period of unseasonably light automobile releases is believed to be about ended.

WITH automobile assemblies this week slated for another drop, probably to about 60,000 units, February output of cars and trucks is likely to approximate only 270,000, a decline of more than 110,000 units from the January total. March production is naturally expected to be higher, but the extent of the gain over February will be gaged entirely by actual car sales.

Anticipated improvement in March motor car construction is already reflected to a slight extent in finished steel releases. Cleveland makers of sheets and strip steel report a limited improvement in sales, and Chevrolet is understood to have purchased significant tonnages in the last week. Ford, however, is holding up shipments of raw materials and parts whenever possible.

CONTINUED weakness in finished steel prices, particularly on sheets and strip steel, has led to drastic action on the part of some of the larger mills. A leading producer is considering a radical revision of extras on wide cold-rolled sheets and strip which would reduce prices on some sizes but leave the base quotations unaltered.

Other changes are in prospect and it is now believed that no general recognition of shaded current prices will be forthcoming when second quarter quotations are announced next week. Rather it is likely that the present published prices will be adhered to rigidly on new business and that stabilization of selling figures may be achieved during the next three months. This would not prevent the shipment of much low-priced tonnage during March and would enable buyers to protect themselves over a considerable part of the first half of the year. THE IRON AGE composite price of finished steel is unaltered at 2.109c. a lb.

Steadily rising scrap prices have not been without influence in forcing mills to adopt a firmer attitude on steel quotations. THE IRON AGE composite price of scrap has again risen sharply, to $14.75 a gross ton, the increase over the last fortnight having been $1 a ton. While weather conditions are still affecting quotations markedly, supply and demand will not likely be regulated for several weeks, during which time a sharp increase in furnace melt may be expected.

IMPORTANT railroad orders include 17,000 tons of rails for the Missouri Pacific, 10,000 tons of accessories for the Western Pacific, 250 refrigerator cars for the Union Refrigerator Transit Co. and 300 box cars for the International Great Northern. Northern Pacific is inquiring for 12 large locomotives in addition to the 1000 freight cars announced last week.

The construction industry is still a growing outlet for steel, fabricated structural awards of the week having totaled 25,950 tons. Plate lettings were 7650 tons and sheet piling orders were 7650 tons. New structural steel projects call for 21,800 tons, compared with 13,600 tons in the previous week and 25,350 tons a fortnight ago.

THE steel industry is naturally evincing considerable interest in the bill introduced into both houses of Congress last week which would abolish the basing point system of quoting prices. The measure is largely a repetition of the chronic agitation on this subject which has characterized the entire New Deal, but it is not known whether or not the current bill has Administration support. Its passage, therefore, is entirely a matter of conjecture.

Of more immediate concern are the plans for a unionization drive in the steel industry which have been announced during the week. However, internal disorganization in the ranks of organized labor now seems likely to be the chief ally of management in combating this move. It is also expected that the several hundred thousand members of the steel company employee representation plans will become very articulate in opposing outside interference with their present arrangements for collective bargaining.

A Comparison of Prices

Market Prices at Date, and One Week, One Month, and One Year Previous;
Advances Over Past Week in Heavy Type, Declines in Italics

Pig Iron

Per Gross Ton:	Feb. 25, 1936	Feb. 18, 1936	Jan. 28, 1936	Feb. 26, 1935
No. 2 fdy., Philadelphia	$21.31	32 $21.31	32 $21.31	32 $20.26
No. 2, Valley furnace	19.50	19.50	19.50	18.50
No. 2 Southern, Cin'ti	20.20	07 20.20	07 20.20	07 19.13
No. 2, Birmingham†	15.50	15.50	15.50	14.50
No. 2 foundry, Chicago*	19.50	19.50	19.50	18.50
Basic, del'd eastern Pa	20.81	32 20.81	32 20.81	32 19.76
Basic, Valley furnace	19.00	19.00	19.00	18.00
Malleable, Chicago*	19.50	19.50	19.50	18.50
Malleable, Valley	19.50	19.50	19.50	18.50
L. S. charcoal, Chicago	25.25	28 25.25	28 25.25	28 24.04
Ferromanganese, seab'd carlots	75.00	75.00	75.00	85.00

†This quotation is for delivery in South; in the North prices are 38c. a ton under delivered quotations from nearest Northern furnace.

*The switching charge for delivery to foundries in the Chicago district is 60c. per ton.

Rails, Billets, etc.

Per Gross Ton:				
Rails, heavy, at mill	$36.37½	$36.37½	$36.37½	$36.37½
Light rails, Pittsburgh	35.00	35.00	35.00	35.00
Rerolling billets, Pittsburgh	29.00	29.00	29.00	27.00
Sheet bars, Pittsburgh	30.00	30.00	30.00	28.00
Slabs, Pittsburgh	29.00	29.00	29.00	27.00
Forging billets, Pittsburgh	35.00	35.00	35.00	32.00
Wire rods, Pittsburgh	40.00	40.00	40.00	38.00
	Cents	Cents	Cents	Cents
Skelp, grvd. steel, P'gh, lb.	1.80	1.80	1.80	1.70

Finished Steel

Per Lb.:	Cents	Cents	Cents	Cents
Bars, Pittsburgh	1.85	1.85	1.85	1.80
Bars, Chicago	1.90	1.90	1.90	1.85
Bars, Cleveland	1.90	1.90	1.90	1.85
Bars, New York	2.20	2.20	2.20	2.13
Plates, Pittsburgh	1.80	1.80	1.80	1.80
Plates, Chicago	1.85	1.85	1.85	1.85
Plates, New York	2.09	2.09	2.09	2.08
Structural shapes, Pittsburgh	1.80	1.80	1.80	1.80
Structural shapes, Chicago	1.85	1.85	1.85	1.85
Structural shapes, New York	2.06¼	2.06¼	2.06¼	2.05¼
Cold-finished bars, Pittsburgh	2.10	2.10	2.10	2.10
Hot-rolled strips, Pittsburgh	1.85	1.85	1.85	1.85
Cold-rolled strips, Pittsburgh	2.60	2.60	2.60	2.60

Finished Steel

Per Lb.:	Feb. 25, 1936 Cents	Feb. 18, 1936 Cents	Jan. 28, 1936 Cents	Feb. 26, 1935 Cents
Hot-rolled annealed sheets, No. 24, Pittsburgh	2.40	2.40	2.40	2.40
Hot-rolled annealed sheets, No. 24, Gary	2.50	2.50	2.50	2.50
Sheets, galv., No. 24, P'gh	3.10	3.10	3.10	3.10
Sheets, galv., No. 24, Gary	3.20	3.20	3.20	3.20
Hot-rolled sheets, No. 10, P'gh	1.85	1.85	1.85	1.85
Hot-rolled sheets, No. 10, Gary	1.95	1.95	1.95	1.95
Wire nails, Pittsburgh	2.10	2.10	2.40	2.60
Wire nails, Chicago dist. mill	2.15	2.15	2.45	2.65
Plain wire, Pittsburgh	2.30	2.30	2.30	2.30
Plain wire, Chicago dist. mill	2.35	2.35	2.35	2.35
Barbed wire, galv., P'gh	2.50	2.50	2.80	3.00
Barbed wire, galv., Chicago dist. mill	2.55	2.55	2.85	3.05
Tin plate, 100 lb. box, P'gh	$5.25	$5.25	$5.25	$5.25

Scrap

Per Gross Ton:				
Heavy melting steel, P'gh	$15.75	$14.75	$14.50	$12.75
Heavy melting steel, Phila	13.75	13.75	12.75	11.50
Heavy melting steel, Ch'go	14.75	14.50	13.50	10.75
Carwheels, Chicago	14.00	14.00	13.00	12.00
Carwheels, Philadelphia	14.75	14.75	14.75	12.50
No. 1 cast, Pittsburgh	14.25	14.25	14.25	13.25
No. 1 cast, Philadelphia	13.75	13.00	13.00	11.00
No. 1 cast, Ch'go (net ton)	13.50	13.00	12.00	10.00
No. 1 RR. wrot., Phila	13.25	13.25	13.25	11.00
No. 1 RR. wrot., Ch'go (net)	13.25	13.25	11.00	8.75

Coke, Connellsville

Per Net Ton at Oven:				
Furnace coke, prompt	$3.65	$3.65	$3.65	$3.85
Foundry coke, prompt	4.25	4.25	4.25	4.60

Metals

Per Lb. to Large Buyers:	Cents	Cents	Cents	Cents
Electrolytic copper, refinery	9.25	9.25	9.25	8.75
Lake copper, New York	9.37½	9.37½	9.37½	9.12½
Tin (Straits), New York	47.62½	47.75	46.30	47.87½
Zinc, East St. Louis	4.90	4.85	4.85	3.75
Zinc, New York	5.27½	5.22½	5.22½	4.10
Lead, St. Louis	4.35	4.35	4.35	3.40
Lead, New York	4.50	4.50	4.50	3.55
Antimony (Asiatic), N. Y.	13.25	12.87½	12.62½	14.50

On export business there are frequent variations from the above prices. Also, in domestic business, there is at times a range of prices on various products, as shown in our detailed price tables.

The Iron Age Composite Prices

	Finished Steel	Pig Iron	Steel Scrap
Feb. 25, 1936	2.109c. a Lb.	$18.84 a Gross Ton	$14.75 a Gross Ton
One week ago	2.109c.	18.84	14.33
One month ago	2.130c.	18.84	13.58
One year ago	2.124c.	17.90	11.67

	Based on steel bars, beams, tank plates, wire, rails, black pipe, sheets and hot-rolled strips. These products represent 85 per cent of the United States output.		Based on average of basic iron at Valley furnace and foundry irons at Chicago, Philadelphia, Buffalo, Valley and Birmingham.		Based on No. 1 heavy melting steel quotations at Pittsburgh, Philadelphia and Chicago.	
	HIGH	LOW	HIGH	LOW	HIGH	LOW
1936	2.130c., Jan. 7	2.109c. Feb. 4	$18.84, Jan. 7	$18.84, Jan. 7	$14.75, Feb. 25	$13.33, Jan. 7
1935	2.130c., Oct. 1	2.124c., Jan. 8	18.84, Nov. 5	17.83, May 14	13.42, Dec. 10	10.33, April 23
1934	2.199c., April 24	2.008c., Jan. 2	17.90, May 1	16.90, Jan. 27	13.00, Mar. 13	9.50, Sept. 25
1933	2.015c., Oct. 3	1.867c., April 18	16.90, Dec. 5	13.56, Jan. 3	12.25, Aug. 8	6.75, Jan. 3
1932	1.977c., Oct. 4	1.926c., Feb. 2	14.81, Jan. 5	13.56, Dec. 6	8.50, Jan. 12	6.43, July 5
1931	2.037c., Jan. 13	1.945c., Dec. 29	15.90, Jan. 6	14.79, Dec. 15	11.33, Jan. 6	8.50, Dec. 29
1930	2.273c., Jan. 7	2.018c., Dec. 9	18.21, Jan. 7	15.90, Dec. 16	15.00, Feb. 18	11.25, Dec. 9
1929	2.317c., April 2	2.273c., Oct. 29	18.71, May 14	18.21, Dec. 17	17.58, Jan. 29	14.08, Dec. 3
1928	2.286c., Dec. 11	2.217c., July 17	18.59, Nov. 27	17.04, July 24	16.50, Dec. 31	13.08, July 2
1927	2.402c., Jan. 4	2.212c., Nov. 1	19.71, Jan. 4	17.54, Nov. 1	15.25, Jan. 11	13.08, Nov. 22

Pittsburgh Steel Output Rises to 39 Per Cent

Wheeling and Valley Production Unchanged With Miscellaneous Steel Demand Holding — Tin Plate Production Rises Sharply—Scrap $1 a Ton Higher

PITTSBURGH, Feb. 25.—Ingot output in the Pittsburgh district is one point higher at 39 per cent. The increase reflects a minor spurt in orders reaching some independent mills, which have stepped up production this week. The leading producer has moderated production slightly.

Miscellaneous business continues to be the backbone of current finished steel demand. Reinforcing steel business booked here in the past week expanded substantially. Buying of automobile steel continues to be on a restricted basis. Releases of steel for railroad car building are not appearing regularly, and some mills that had banked heavily on this business for first quarter have been forced to curtail plate output temporarily.

Tin plate output has been increased 10 points to 75 per cent of capacity, and strip steel five points to 45 per cent. Sheet mill schedules are unchanged at 65 per cent.

Ingot operations in the Valleys and nearby northern Ohio mills and in the Wheeling district are unchanged at 60 per cent and 80 per cent respectively.

Steel producers will likely open books on March 1 for second quarter tonnage, and it is indicated that current base prices, which have been extremely irregular in recent weeks, will be more firmly established. Meanwhile, concessions on strips, sheets, wire nails and reinforcing bars are still widespread. It is not entirely improbable that a mercurial scrap market will impart some firmness eventually to finished steel prices, providing the behavior of scrap quotations is not entirely based on recent emergency weather conditions. No. 1 heavy melting steel at Pittsburgh has advanced $1 a ton.

Pig Iron

Producers have not officially opened books for second quarter shipment, but no changes in present furnace quotations are contemplated for that period. Meanwhile, the market continues to be restricted to car-lot transactions, with full prices being applied in practically all instances. Lack of irregularity in quoting, while partly attributable to the absence of large tonnages, is traceable also to unusual strength in scrap quotations. This latter support, however, is provided by general strength in the entire scrap market rather than in cast grades.

Semi-Finished Steel

Prices still are not clearly definable. Large non-integrated mills which have taken deliveries of semi-finished material since Feb. 15 contend that billings are at the old prices in effect last fall. The only evident exception is in wire rods, which have moved in small quantities at the full price of $40 a gross ton, Pittsburgh. That price in one special instance, however, has been shaded $2 a ton, equivalent to the old basis. Rerolling billets, slabs and sheet bars are being shipped freely at old quotations. It does not appear likely, therefore, that the current nominal quotations will be firmly established until the beginning of second quarter.

Bars

Merchant bar prices, relatively speaking, are firmer than some other steel products on which irregularities have spread in the past month. At Pittsburgh, the 1.85c. base price is uncommonly steady. Incoming orders from the automotive industry are spotty, but miscellaneous business is holding recent volumes.

Bolts, Nuts and Rivets

Aggregate demand thus far in February is lagging slightly behind January business. The setback, which is due largely to poor automotive demand, has been offset considerably by a welcome flow of orders from car builders in this and other districts. Second quarter prices are likely to be announced next week.

Reinforcing Steel

The Jones & Laughlin Steel Corpn. has been awarded 4000 tons of floor trusses for the Triborough Bridge at New York. On 9000 tons for Fort Peck, Mont., dam tunnels, the Sheffield Steel Corpn. was low bidder, with the delivered quotation reflecting a $4 a ton concession from the ruling base price. The Pittsburgh distributers' market is a shade firmer than other districts. Prices quoted by distributers here range from 1.85c. to 2.05c.

Cold-Finished Bars

Little change is evident in automotive demand, which remains at a low point, and in miscellaneous takings, which are holding their own. Prices remain firm. While some second quarter inquiry has appeared, producers have not established their position for that period. At this writing, indications point to a reestablishment of the present base, although this will depend, of course, upon the extension of the present hot-rolled bar base quotation at Pittsburgh.

Plates and Shapes

The Treadwell Construction Co. has received an order from an Eastern interest for a steel gold-digging dredge, entailing 1200 tons of plates, for South American delivery. River traffic remains at a standstill, and barge construction and repair work are progressing slowly. Releases from railroad car builders are being placed sporadically.

Fabricated structural steel awards reported here in the past week increased sharply over those in the preceding period. A section of the express highway, involving 1470 tons, was let to American Bridge Co. A sprinkling of private projects provide an encouraging aspect of the week's awards.

Prices for plates and shapes are not escaping the general unsettlement in steel quotations. Sharp concessions are still widespread on fabricated structural steel bids.

Sheet Steel Piling

The Tennessee Valley Authority has awarded 4420 tons to Inland Steel Co. for a dam at Guntersville, and 3200 tons to Bethlehem Steel Co. for a dam at Chickamauga. Similar quotations were submitted on delivered bases at Sheffield and Hobbs Island, Ala., and Chattanooga, Tenn., with drawings for successful bidders deciding disposition of the tonnage.

Tubular Products

This market lacks feature excepting that discussions of line pipe projects have awakened after a long slumber. The Indiana-to-Michigan natural gas line has not yet arrived at the bidding stage, but this prospect offers the bright-

est spot in the line pipe market. Oil-country goods are following their characteristically steady course, while boiler tube orders are slightly improved. Pipe tonnage in February is expected to be on a parity with that for January. Operations in this district are averaging about 45 per cent of capacity. Although producers have not announced second quarter quotations, no change for that period is considered in the making.

Wire Products

Prices for bright wire and spring wire for the manufacturing trade are not emulating the erratic behavior of those for merchant items. In the Pittsburgh district, merchant quotations have not been so irregular as those in other districts, but there is evidence of sharp concessions in base price for wire nails. These irregularities, however, are to be found largely in outlying points in the district. As a result of the unsteadiness of merchant quotations, consumers have retreated and apparently are awaiting a more definite course in quotations. Quoting for second quarter has not begun.

Sheets

Both automotive and miscellaneous demand expanded slightly in the past week, with the increase in unclassified tonnage showing the greater improvement. The more active interest, however, has not crystallized to a point where mill operations are headed higher, and output for the sheet industry in the current week remains unchanged at 65 per cent of capacity. Some business is being placed by automotive interests for requirements as far ahead as May, but at the moment there is no sign of a broad resumption in buying by the motor car industry. Although prices are still subject to widespread concessions and promise little improvement for the time being, prospects for a more stable price structure in the coming quarter are shaping up a little more definitely. A clear cut price policy may put in an appearance upon announcement of second quarter prices probably at the outset of next week.

Tin Plate

General line can and packers' requirements are showing up unusually well, and the influx of specifications in the past week was sufficient to boost operations for the current period 10 points to 75 per cent of capacity. This rate of production is considered unusual in the face of still heavy stocks in mill hands. Export demand is figuring noticeably in the current movement.

Strip Steel

Producers in this district report a spurt in orders for the past week. The improvement originated almost entirely among miscellaneous consuming groups. Stamping plants and parts makers continue to limit specifications to bare needs, and there is no indication in sight that portends the early resumption of important automotive buying. Hot-rolled output has been temporarily lifted five points this week to 45 per cent of capacity as a result of the improved demand last week. Prices are not indicating any firming tendencies, and concessions of $3 a ton continue to be the general rule.

Coal and Coke

Waterways in this district have been made impassable by ice jams, and, despite a two-day thaw, the market is still under the tension of cold weather demand. Unfilled orders for domestic coal and coke still are heavy. There still is an emergency call for both domestic and industrial grades from the Mid-West and Northwest. Prices have not reached any higher ground on the strength of the substantial demand, but are retaining their recent firm tone. With the exception of demand for domestic coke, the coke market is relatively quiet.

Scrap

Two mills in the Pittsburgh district have purchased a total of at least 15,000 tons of No. 1 heavy melting steel at $16, delivered, reflecting a $1 a ton advance over the last sizable transaction. While some of this scrap probably will be furnished from local yards, a substantial portion will come from distant points. Practically all other grades are nominally higher. The upward surge of scrap prices has received its chief impetus from paralyzing weather conditions and the consequent scarcity of materials moving into this district, which depends a great deal upon outside sources for its scrap supplies. Present values, moreover, have resulted partly from the high freight rates applying to an increasing share of shipments into this district from distant sources. River deliveries are still impossible owing to ice jams, but some relief appears to be imminent as a result of extremely mild weather in the past few days. The current Pennsylvania Railroad list, which closes on March 4, covers about 26,500 tons, including 9500 tons of No. 1 heavy melting steel.

International Selling Corpn., New York, importer of all types of steel-making ores, is moving its offices from 70 Pine Street to 26 Beaver Street, where the company will occupy the entire fifteenth floor.

Weekly Indications of Steel Activity

From THE IRON AGE

	Feb. 25, 1936	Feb. 18, 1936	Jan. 28, 1936	Feb. 26, 1935	Average Year to Date 1936	Average Year to Date 1935
Steel ingot operations—Per cent of capacity	55.0	53.5	50.5	48.5	51.8	50.5

	Week Ended Feb. 25, 1936	Feb. 18, 1936	Jan. 28, 1936	Feb. 26, 1935	Year to Date 1936	Year to Date 1935
Fabricated structural steel awards	25,950	33,215	28,700	6,700	175,785	114,605
Fabricated plate awards	7,650	1,945	875	1,460	63,452	44,965
Sheet steel piling awards	7,685	0	0	0	14,045	4,300
Reinforcing bar awards	13,735	3,100	27,460	5,000	86,040	54,815

Reinforcing Steel

Awards 13,735 Tons—New Projects 4800 Tons

AWARDS

New York, 4000 tons, bridge flooring for Triborough bridge, to Jones & Laughlin Steel Corpn.; Tully & Di Napoli, Inc., Long Island City, N. Y., general contractor.

New York, 710 tons, Triborough bridge, to Carroll-McCreary Co., Inc.

New York, 1400 tons, trusses for Triborough bridge, to Concrete Steel Co.

Carmel, N. Y., 200 tons, New York Central grade crossing elimination, to Albany Steel & Iron Co.

Niagara Falls, N. Y., 800 tons, sewage disposal plant, to Recon, Inc., Buffalo.

Hershey, Pa., 300 tons, ice rink, to Wrought Iron Co. of America.

Hammond, Ind., 400 tons. Lever Brothers, to Concrete Steel Co.

Du Page County, Ill., 110 tons, bridge, to Calumet Steel Co.

Topeka, Kan., 1700 tons, viaduct, to Sheffield Steel Corpn.

Fort Peck, Mont., 1500 tons, material for dam, to Laclede Steel Co.

Seattle, 100 tons, plant addition for Century Brewery Co., to Northwest Steel Rolling Mills.

Seattle, 800 tons, Montgomery Ward building, to Northwest Rolling Mills.

Ellensburg, Wash., 100 tons, addition to State normal school, to Truscon Steel Co.

Pueblo County, Colo., 442 tons, State undercrossing, to an unnamed bidder.

Los Angeles, 327 tons, Iron Mountain pumping plant, to an unnamed bidder.

Los Angeles, 100 tons, State overhead crossing at Soto Street, to an unnamed bidder.

Los Angeles, 335 tons, State undercrossing at Mission Road, to an unnamed bidder.

State of Idaho, 122 tons, State bridges in three counties, to unnamed bidders.

Santa Barbara, Cal., 277 tons, post office, to Bethlehem Steel Corpn.

NEW REINFORCING BAR PROJECTS

Nashua, N. H., 200 tons, high school.

State of Rhode Island, 180 tons, four State bridges.

South Kingston, R. I., 114 tons, bridge.

Howard, R. I., 100 tons, hospital unit.

Boston, 100 tons, Navy Yard No. 1 pier repairs.

Middletown, Conn., 1000 tons, bridge over Connecticut River; bids March 9.

Philadelphia, 1000 tons, two high schools; bids March 6.

Chicago, 200 tons, division D for Sanitary District.

State of Illinois, tonnage not stated, bridge and paving work; bids March 3.

Peoria, Ill., 700 tons, two rack houses for Hiram Walker.

State of Wisconsin, 220 tons, 10 highway projects; bids March 6.

Kansas City, Mo., 1700 tons, intercity viaduct; M. E. Gillioz, Monett, Mo., low bidder on general contract.

Fort Peck, Mont., 9000 tons, material for tunnel work; Sheffield Steel Corpn., low bidder.

A drive exposed to moisture, steam, dust, or grit is a "natural" for Baldwin - Duckworth roller chain. Here are two such drives installed in the dust-laden air of a grain elevator—yet they have run for years without attention under conditions that would speedily destroy other types of drives. Baldwin - Duckworth Roller Chain will give the same uninterrupted service on any such drives in your plant.

Baldwin-Duckworth standard roller chains and sprockets in varying sizes and types will operate effectively up to 4,000 R.P.M. and will transmit up to 500 H.P. Our engineers will advise you on selection and installation. Baldwin - Duckworth Chain Corporation, Springfield, Mass.

Above: Conveyor drive — 498 R.P.M. on drive sprocket.

Below: High torque triple drive. Note enclosed ventilation protection needed by motor.

BALDWIN—DUCKWORTH

Weld County, Colo., 157 tons, State bridge between Greeley and La Salle; bids March 3.

Douglas, Ariz., 143 tons, State undercrossing; bids March 10.

State of Montana, 112 tons, State bridges in three counties; bids March 28.

Missoula, Mont., 115 tons, State overpass on Orange Street; bids March 28.

Spokane, Wash., 200 tons, post office; bids rejected.

Spokane County, Wash., 260 tons, State overhead crossing near Parkwater; bids opened.

Conveying Problems Surveyed in Booklet

MATHEWS CONVEYER CO., Ellwood City, Pa., has issued an attractive 60-page booklet illustrating the solution of materials handling problems in a variety of industries. The title is "Problems Solved With Mathews' Conveyer Systems."

A large part of this publication is devoted to problems arising in the various divisions of the metalworking industry such as automotive conveying, foundries, both ferrous and non-ferrous, steel plants and machine shops.

Chicago Steel Output Rises to 63 Per Cent

Ingot Production Up Three Points With Implement and Road Machinery Activity Increasing—Scrap Again Rises

CHICAGO, Feb. 25.—Ingot output has reached 63 per cent of capacity, a gain of three points, and the outlook is for a still higher rate. Tractor and farm implement manufacturers are taking more steel, and road machinery builders, still busy on snow removal equipment, are expanding production in road building machinery departments. Car shops are beginning to order out materials for new car orders and railroad shops are more active, both on repair work and on cars which the railroads will build in their own shops.

Another factor tending toward heavier ingot output is that many outlying plants, starved for supplies by snow and cold, are now energetically trying to make up lost ground. A few rail contracts have been enlarged by moderate amounts and the Missouri Pacific has placed orders for spring requirements. The Colorado rail mill has been stepped up to a seven-day week. There are in prospect in the next 10 days to two weeks substantial purchase of automobile sheets. New railroad equipment purchases include 300 box cars by the Missouri Pacific and 250 refrigerators by the Union Refrigerator Transit Co.

Price confusion has now spread to sheets and strip and there is uneasiness in quotations on shapes. On the other hand, reinforcing bars have a stronger tone and it is not beyond the realm of possibility that finished steel prices may firm up.

Pig Iron

Melters' stock piles that grew in November and December are badly shrunk and important buying may readily develop soon after March 1 when second quarter prices will be announced. All factors now point to extension of present quotations. One automobile foundry has increased its melt and others are looking forward to a like move in March.

Wire Products

Prices to the trade remain in a demoralized condition and order books are suffering as a result. Backlogs continue to dwindle but producers are holding to production schedules in order that their warehouse stocks will be ample in size and well balanced for the spring trade which they believe will be heavy. Many country areas now released from cold and snow are confronted with a fast thaw which makes roads impassable and raises many streams to high flood stage. It will probably be several weeks before jobbers will begin to feel real pressure against their meager stocks. Encouragement is coming from the railroads which are making inquiries. The manufacturing trade is steady though tonnages moving in that direction are still crippled by the small use of wire and wire products by automobile plants.

Sheets

Price weakness has spread to this district and all grades are now quotable at spreads of $3 a ton. Sales have dropped back in recent days and some sellers blame price confusion for the condition, pointing out that there is no noticeable drop in consumption. It is reported here that automobile sheet buying is taking shape and that some heavy tonnages will be figured on within a week to ten days.

Rails

It is reported that the Missouri Pacific has ordered 10,000 tons of rails and no account is given of the remainder of 17,000 tons which was reported as an inquiry last week. Several western railroads have added small lots to recent purchases, the aggregate being 2000 tons. It is important to observe that mills are now operating at a higher rate than a year ago and that their releases assure steady output until past the middle of May. This is in sharp contrast with the reluctance to specify shown by railroads in the early part of 1935.

Plates

Demand for this product is spotty but it promises to grow heavier. Bethlehem Steel Corpn. is low on 9000 tons of pipe at St. Louis and an award has been made for 700 tons for a tank at Fort Knox. A lighthouse tender calls for 550 tons and car shops are starting to order out materials for recently placed railroad equipment. Railroad shops continue to press repair work and some of them are starting on new car construction.

Bars

Both specifications and new orders are up, based largely on quick needs from many small outlying plants that have been handicapped by the weather in getting in shipments. Other factors are the speeding up of road machinery, tractor and farm implement plants.

Road machinery makers are still busy in snow removal equipment departments and they are now speeding toward full capacity on road building units.

Structural Material

Prices for shapes are showing signs of variation when applied to some of the more attractive tonnages. Awards are attractive, at about 11,000 tons and inquiries are fairly brisk considering that the weather has been holding in check most out-of-doors work. In fact structural orders to mills have been lighter in recent days on account of the backing up of fabricated materials in shop yards.

Cast Iron Pipe

The long stretch of cold weather with roads that in many cases are still impassable for heavy loads has been an effective check on the cast iron pipe market. New buying is turning slower and shipments are very light to central and northern states. After having rejected bids Cicero, Ill., has taken no further steps on its large tonnage. Prices remain steady with no tendency to move one way or the other.

Reinforcing Bars

Milder weather gives promise that the long severe winter is breaking. However, it will still be some weeks before shipments will stage a satisfactory climb and it may be a month or more before contractors can be assured that most of the exceptionally deep frost will be out of the ground. Projected plans are increasing in number and there is still a large

amount of WPA work to be done. There is greater prospect of private work and the spring months hold promise. The industry is showing interest in a better price level which may be a development in the near future.

Scrap

Prices continue their upward march and there is no sign of lack of strength at the new high levels. Mills have freely paid $15 a ton for heavy melting steel and users of specialties are most concerned about getting needed supplies than in the soaring tendencies of prices. Nearby territories are using more of their own scrap and the matter of adequate supplies for Chicago area users is daily growing more serious. It is doubtful if moderate weather will have any material effect toward retarding the strength of the price situation.

Rail and Pipe Orders Placed at St. Louis

ST. LOUIS, Feb. 25.—The Missouri Pacific railroad has ordered 17,000 tons of 90 and 112-lb. rails and approximately 1,000,000 tie plates from Bethlehem Steel Co., Inland Steel Co., Carnegie-Illinois Steel Corpn., Tennessee Coal, Iron & Railroad Co. and Colorado Fuel & Iron Co. The International-Great Northern's rail requirements of 4500 tons are included.

Bethlehem Steel Corpn. made a low bid of $542,880 for furnishing, coating and delivering 17,357 ft. of 60-in., 9/16-in. and 29,400 ft. of 60-in. ½-in. thick, a total of 9000 tons of welded steel pipe and required couplings for conduit from Howard Park Pumping Station to Stacy Park Reservoir for the Board of Public Service.

Laclede Steel Co. has been awarded 1500 tons of reinforcing bars for the Fort Peck, Mont., dam, and Sheffield Steel Corpn. is apparently low bidder on 8553 tons of this material for the same project. Sheffield Steel Corpn. also has been awarded 1700 tons of reinforcing bars for a viaduct at Topeka, Kan.

Operations in the seven leading structural steel fabricating plants have been stepped up to about 50 per cent of capacity, with one firm at 75 per cent of capacity.

The market for scrap iron continues firm, although prices, which had been steadily advancing for several weeks are unchanged. Dealers say that the mills in the St. Louis industrial district want to buy scrap, but are reluctant to meet the dealers' offers. The tendency is towards increased consumption. The supply of scrap continues scarce, and dealers say that they look for a shortage in the spring. Mills stocks are said to be low.

Stove foundries in Belleville, whose operations had been halted since Jan. 1 on account of a strike of enamelers, have resumed work, adding substantially to the melt of pig iron in the district. Reports from the Tri-cities tell of heavy operations by the agricultural implement interests. One firm, which expects this to be the biggest February in its history, has put on a night shift. Sales and shipments of pig iron have been light, although February is expected to show a better movement than January. Some buying is expected after March 1.

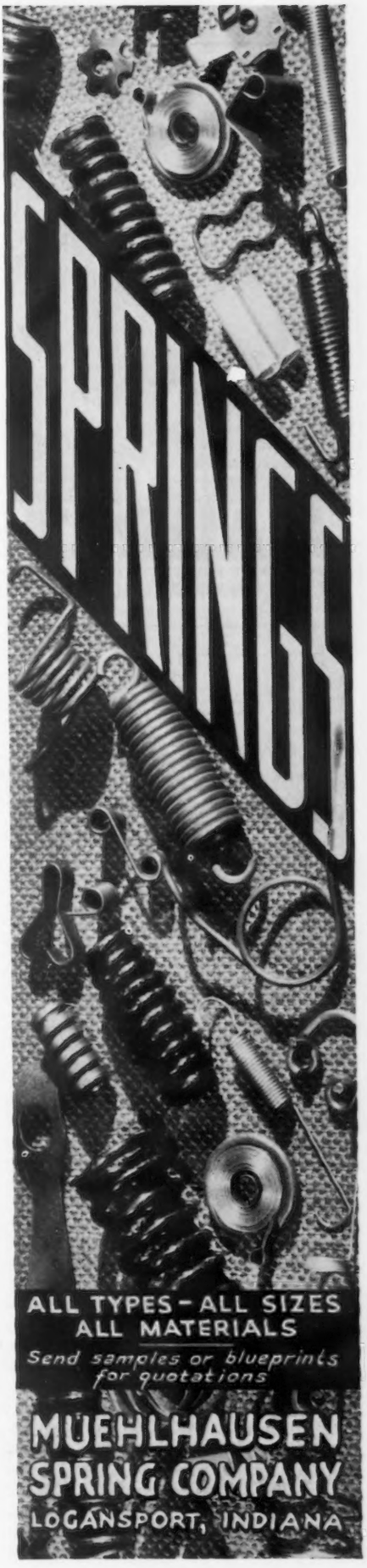
Steel Operations Unchanged in South

BIRMINGHAM, Feb. 25.—Bookings of heavy steel are maintained at favorable rate. Bars, plates and structural shapes have shown a marked upward trend lately. There have also been some additional rail orders. Gulf, Mobile & Northern is reported to have bought 3000 tons and the Mobile & Ohio 3000 tons. The cumulative volume of highway and PWA construction placed under contract during the past several months is now providing substantial new steel tonnage. Bad weather is still affecting demand for sheets and wire products.

Pig iron buying is not active on account of previous bookings. There should be a change, however, toward the end of March as stocks and commitments are cleared up. Although books have not been opened for the second quarter, it is stated that the current price of $15.50 will be reaffirmed. February shipments are ahead of January.

Blast furnace and open-hearth operations this week are the same as last. Twelve blast furnaces and 15 open-hearth units are in production.

United States Pipe & Foundry Co. was low bidder last week on 2250 tons of 16-in. and 24-in. cast iron pipe for Birmingham's $5,800,000 industrial water system. Specifications will probably be completed this week on 13,000 tons of steel pipe, ranging from 42 in. to 60 in., which will be purchased by the WPA for the project. The balance of the 24,000 tons will be bought with PWA funds.



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Buffalo Steel Output Lower This Week

BUFFALO, Feb. 25.—Steel mill operations are off from last week with Bethlehem Steel Corpn.'s active open-hearths down to eight. Republic Steel Corpn. continues two; Wickwire-Spencer Steel Co., one, and the Seneca sheet division of Bethlehem is down to 60 per cent as against 75 last week. This sheet mill's schedule is expected to remain stationary or even dip over the next week.

A Buffalo concern has the contract for 800 tons of reinforcing bars for the new Niagara Falls sewage displosal plant. This contractor will have the steel fabricated by a mill. The material will be partly rail steel and partly new billets. Bids for the 600-ton Jamestown, N. Y., grade crossing highway bridge project have been rejected and will be taken again March 10. To be bid is a 100-ton job for the Sullivan Store building in Elmira, N. Y., and 1000 tons of structural steel for the new storage building of the Corning Glass Works, Corning, N. Y. This building will be unique in that it will be constructed of steel and translucent glass blocks.

The influence of outside markets finally has raised the levels of Buffalo scrap prices. No. 1 steel from Buffalo has brought $15.75, Youngstown, and No. 2 steel, $14.75, Youngstown, on the basis of $13 and $12, Buffalo, respectively. Material is moving out of this district on these orders. New hydraulic compressed sheets are bringing $15.25, Youngstown, or $12.50, Buffalo. Machine shop turnings have been sold at $8 to $8.50, Buffalo, within the past week. Dealers viewing the free movement of scrap into other districts are forecasting a shortage in this district.

Boston Exporters Face Scrap Shortage

BOSTON, Feb. 25.—Activity in the export scrap market is confined to one cargo of 7600 tons for Italy, and, because of weather conditions, shippers have been hard put for material. Other exporters have temporarily withdrawn from the market. Current sales of export No. 2 steel generally are at $9.75 a ton, delivered Army Base here, but $10 has been done, and as high as $11 paid for No. 1 steel and small lots of scrap rails. Such prices represent advances of 25c to 50c a ton. Shafting prices also are higher, and for breakable cast, $8.25 a ton, flat, prevails. Scattered lots of stove plate at $7 a ton, Army Base, for Japan, cotton ties at $6 a ton, f.o.b., steel turnings at $4.40, and bundled skeleton at $7.65, for Pennsylvania delivery, are changing hands. Because of frozen rivers and waterways south of New England, shipments of stipped engine blocks are deadlocked. Foundries are taking machinery and textile cast a little more freely, but mostly in truck lots.

New England melters evince a little more interest in pig iron, but only for prompt shipment. Nearly 1000 tons was booked by furnaces in the past week. A few hundred tons of Indian iron landed about a week ago have been delivered to consumers. Prices for domestic brands and India iron are holding firmly. Foundry operations are looking up with indications of materially increasing in March.

Western Pacific Rail Order Placed on Coast

SAN FRANCISCO, Feb. 25.—The purchase of 31,000 tons of rails by the Western Pacific Railroad Co. was the second largest Pacific Coast rail letting in over two years, exceeded only by the Southern Pacific Co.'s purchase last December of 40,769 gross tons. It is reported that 21,000 tons has been placed with Colorado Fuel & Iron Co., while Columbia Steel Co., a subsidiary of United States Steel Corpn., will furnish 10,000 tons.

The possibility of an inquiry for 12,000 tons of sheet piling for a retaining wall for the Exposition grounds, to be filled in on the shoals in San Francisco Bay, evaporated with the announcement that wood pile and rock construction would be used. Recent favorable action by Congress on national defense legislation should revive interest in the long contemplated floating drydocks to be constructed on the West Coast for use at Pearl Harbor, T. H. The project, costing $10,000,000, will involve 43,120 tons of steel, according to Bureau of Yards and Docks estimates.

Outstanding among recent bookings was the award at San Francisco of 4400 tons of plates to Western Pipe & Steel Co. The 6661 tons of reinforcing bars, involved in the Colorado River aqueduct general contract placed with American Concrete & Steel Pipe Co., has been placed with an unnamed mill. Bethlehem Steel Corpn. took 320 tons of structural steel and 277 tons of reinforcing bars for the Santa Barbara post office.

Purchases of the Treasury Department have been of fair number and volume. The latest is the contract for 1362 tons of 36-in. steel pipe on which bids will be opened tomorrow at San Francisco. Other new inquiries are mostly for highway crossings although it is reported that Federated Metals Co. will take bids soon on two factory buildings at Los Angeles.

Prices of Finished Steel and Iron Products

BARS, PLATES, SHAPES

Iron and Steel Bars

	Soft Steel Base per Lb.
F.o.b. Pittsburgh	1.85c.
F.o.b. Chicago	1.90c.
F.o.b. Gary	1.90c.
F.o.b. Duluth	2.00c.
Del'd Detroit	2.00c.
F.o.b. Cleveland	1.90c.
F.o.b. Buffalo	1.95c.
Del'd Philadelphia	2.16c.
Del'd New York	2.20c.
F.o.b. Birmingham	2.00c.
F.o.b. cars dock Gulf ports	2.25c.
F.o.b. cars Pacific ports	2.40c.

Rail Steel

(For merchant trade)

F.o.b. Pittsburgh	1.70c.
F.o.b. Chicago	1.75c.
F.o.b. Gary	1.75c.
F.o.b. Moline, Ill.	1.75c.
F.o.b. Cleveland	1.75c.
F.o.b. Buffalo	1.80c.
F.o.b. Birmingham	1.85c.
F.o.b. cars dock Gulf ports	2.10c.
F.o.b. cars dock Pacific ports	2.25c.

Billet Steel Reinforcing

(Straight lengths as quoted by distributors)

F.o.b. Pittsburgh	1.85c. to 2.05c.
F.o.b. Chicago	1.90c. to 2.10c.
F.o.b. Gary	1.90c. to 2.10c.
Del'd Detroit	2.00c. to 2.20c.
F.o.b. Cleveland	1.90c. to 2.10c.
F.o.b. Youngstown	1.90c. to 2.10c.
F.o.b. Buffalo	1.90c. to 2.10c.
F.o.b. Birmingham	1.90c. to 2.10c.
F.o.b. cars dock Gulf ports	2.45c.
F.o.b. cars dock Pacific ports	2.45c.

Rail Steel Reinforcing

(Straight lengths as quoted by distributors)

F.o.b. Pittsburgh	1.70c. to 1.90c.
F.o.b. Chicago	1.75c. to 1.95c.
F.o.b. Gary	1.75c. to 1.95c.
F.o.b. Cleveland	1.75c. to 1.95c.
F.o.b. Youngstown	1.75c. to 1.95c.
F.o.b. Buffalo	1.75c. to 1.95c.
F.o.b. Birmingham	1.75c. to 1.95c.
F.o.b. cars dock Gulf ports	2.30c.
F.o.b. cars dock Pacific ports	2.30c.

Iron

F.o.b. Chicago	1.80c.
F.o.b. Pittsburgh (refined)	2.10c.
Delivered New York	2.05c.
Delivered Philadelphia	2.10c.

Cold Finished Bars and Shafting*

	Base per Lb.
F.o.b. Pittsburgh	2.10c.
F.o.b. Chicago	2.15c.
F.o.b. Gary	2.15c.
F.o.b. Cleveland	2.15c.
F.o.b. Buffalo	2.20c.
Del'd Detroit	2.30c.
Del'd eastern Michigan	2.35c.

* In quantities of 10,000 to 19,999 lb.

Fence and Sign Posts

Angle Line Posts

	Base per Net Ton
F.o.b. Pittsburgh	$54.00
F.o.b. Chicago	54.00
F.o.b. Duluth	55.00
F.o.b. Cleveland	54.00
F.o.b. Birmingham	57.00
F.o.b. Houston, Orange, Beaumont, Galveston	63.00
F.o.b. Mobile	62.00
F.o.b. New Orleans, Lake Charles, Corpus Christi	63.00
F.o.b. cars dock Pacific ports	67.00

Plates

	Base per Lb.
F.o.b. Pittsburgh	1.80c.
F.o.b. Chicago	1.85c.
F.o.b. Gary	1.85c.
Del'd Cleveland	1.995c.
F.o.b. Coatesville	1.90c.
F.o.b. Sparrows Point	1.90c.
Del'd Philadelphia	1.99c.
Del'd New York	2.09c.
F.o.b. Birmingham	1.95c.
F.o.b. cars dock Gulf ports	2.20c.
F.o.b. cars dock Pacific ports	2.35c.
Wrought iron plates, f.o.b. P'gh	3.20c.

Floor Plates

	Base per Lb.
F.o.b. Pittsburgh	3.35c.
F.o.b. Chicago	3.40c.
F.o.b. Coatesville	3.45c.
F.o.b. cars dock Gulf ports	3.75c.
F.o.b. cars dock Pacific ports	3.90c.

Structural Shapes

	Base per Lb.
F.o.b. Pittsburgh	1.80c.
F.o.b. Chicago	1.85c.
Del'd Cleveland	1.995c.
F.o.b. Buffalo	1.90c.
F.o.b. Bethlehem	1.90c.
Del'd Philadelphia	2.015c.
Del'd New York	2.0625c.
F.o.b. Birmingham (standard)	1.95c.
F.o.b. cars dock Gulf ports	2.20c.
F.o.b. cars dock Pacific ports	2.35c.

Steel Sheet Piling

	Base per Lb.
F.o.b. Pittsburgh	2.15c.
F.o.b. Chicago	2.25c.
F.o.b. Buffalo	2.25c.
F.o.b. cars dock Gulf ports	2.60c.
F.o.b. cars dock Pacific ports	2.60c.

SHEETS, STRIP, TIN PLATE TERNE PLATE

Sheets

Hot Rolled

	Base per Lb.
No. 10, f.o.b. Pittsburgh	1.85c.
No. 10, f.o.b. Gary	1.95c.
No. 10, del'd Detroit	2.05c.
No. 10, del'd Phila.	2.16c.
No. 10, f.o.b. Birmingham	2.00c.
No. 10, f.o.b. cars dock Pacific ports	2.40c.

Hot-Rolled Annealed

No. 24, f.o.b. Pittsburgh	2.40c.
No. 24, f.o.b. Gary	2.50c.
No. 24, del'd Detroit	2.45c. to 2.60c.
No. 24, del'd Phila.	2.71c.
No. 24, f.o.b. Birmingham	2.55c.
No. 24, f.o.b. cars dock Pacific ports	3.05c.
No. 24, wrought iron, Pittsburgh	4.30c.

Heavy Cold-Rolled

No. 10 gage, f.o.b. Pittsburgh	2.50c.
No. 10 gage, f.o.b. Gary	2.60c.
No. 10 gage, f.o.b. Detroit	2.55c. to 2.70c.
No. 10 gage, del'd Phila.	2.81c.
No. 10 gage, f.o.b. Birmingham	2.65c.
No. 10 gage, f.o.b. cars dock Pacific ports	3.10c.

Light Cold-Rolled

No. 20 gage, f.o.b. Pittsburgh	2.95c.
No. 20 gage, f.o.b. Gary	3.05c.
No. 20 gage, del'd Detroit	3.00c. to 3.15c.
No. 20 gage, del'd Phila.	3.26c.
No. 20 gage, f.o.b. Birmingham	3.10c.
No. 20 f.o.b. cars dock Pacific ports	3.50c.

Galvanized Sheets

No. 24 gage, f.o.b. Pittsburgh	3.10c.
No. 24, f.o.b. Gary	3.20c.
No. 24, del'd Phila.	3.41c.
No. 24, f.o.b. Birmingham	3.25c.
No. 24, f.o.b. cars dock Pacific ports	3.70c.
No. 24, wrought iron, Pittsburgh	4.95c.

Long Ternes

No. 24, unassorted 8-lb. coating f.o.b. Pittsburgh	3.40c.
F.o.b. Gary	3.50c.
F.o.b. cars dock Pacific ports	4.10c.

Vitreous Enameling Stock

No. 20, f.o.b. Pittsburgh	3.10c.
No. 20, f.o.b. Gary	3.20c.
No. 20, f.o.b. Birmingham	3.70c.
No. 20, f.o.b. cars dock Pacific ports	3.70c.
No. 10, f.o.b. Pittsburgh	2.50c.
No. 10, f.o.b. Gary	2.60c.
No. 10, f.o.b. Birmingham	3.10c.
No. 10, f.o.b. cars dock Pacific ports	3.10c.

Tin Mill Black Plate

No. 28, f.o.b. Pittsburgh	2.75c.
No. 28, Gary	2.85c.
No. 28, cars dock Pacific Coast ports	3.35c.

Tin Plate

	Base per Box
Standard cokes, f.o.b. P'gh district mill	$5.25
Standard cokes, f.o.b. Gary	5.35
Standard cokes, f.o.b. cars dock Pacific ports	5.90

Terne Plate

(F.o.b. Pittsburgh)

(Per Package, 20 x 28 in.)

8-lb. coating I.C.	$10.00
15-lb. coating I.C.	12.00
20-lb. coating I.C.	13.00
25-lb. coating I.C.	14.00
30-lb. coating I.C.	15.25
40-lb. coating I.C.	17.50

Hot-Rolled Hoops, Bands, Strips and Flats under ¼ In.

	Base per Lb.
All widths up to 24 in., P'gh	1.85c.
All widths up to 24 in., Chicago	1.95c.
All widths up to 24 in., del'd Detroit	2.05c.
All widths up to 24 in., Birmingham	2.00c.
Cooperage stock, Pittsburgh	1.95c.
Cooperage stock, Chicago	2.05c.

Cold-Rolled Strips

	Base per Lb.
F.o.b. Pittsburgh	2.60c.
F.o.b. Cleveland	2.60c.
Del'd Chicago	2.895c.
F.o.b. Worcester	2.80c.

Fender Stock

No. 14, Pittsburgh or Cleveland	2.90c.
No. 14, Worcester	3.30c.
No. 20, Pittsburgh or Cleveland	3.30c.
No. 20, Worcester	3.70c.

WIRE PRODUCTS

(Carload lots, f.o.b. Pittsburgh and Cleveland.)

To Manufacturing Trade	*Per. Lb.*
Bright wire	2.30c.
Spring wire	2.90c.

Chicago prices on products sold to the manufacturing trade are $1 a ton above Pittsburgh or Cleveland. Worcester and Duluth prices are $2 a ton above, Birmingham $3 above, and Pacific Coast prices $9 a ton above Pittsburgh or Cleveland.

To the Trade	*Base per Keg*
Standard wire nails	$2.10 to $2.40
Smooth coated nails	2.10 to 2.40

	Base per 100 Lb.
Annealed fence wire	$2.15 to $2.45
Galvanized fence wire	2.50 to 2.80
Polished staples	2.80 to 3.10
Galvanized staples	3.05 to 3.35
Barbed wire, galvanized	2.50 to 2.80
Twisted barbless wire	2.50 to 2.80
Woven wire fence, base column	61.00
Single loop bale ties, base column	53.00

Chicago and Anderson, Ind., mill prices are $1 a ton over Pittsburgh base (on all products except woven wire fence, for which the Chicago price is $2 above Pittsburgh); Duluth, Minn., mill prices are $2 a ton over Pittsburgh except for woven wire fence, which is $3 over Pittsburgh, and Birmingham mill prices are $3 a ton over Pittsburgh.

On wire nails, barbed wire, staples and fence wire, prices at Houston, Galveston and Corpus Christi, Tex., New Orleans, Lake Charles, La., and Mobile, Ala., are $6 a ton over Pittsburgh, while Pacific Coast prices are $8 over Pittsburgh. Exception: on fence wire Pacific Coast prices are $11 a ton above Pittsburgh.

On staples and barbed wire, prices of $6 a ton above Pittsburgh are also quoted at Beaumont and Orange, Tex.

Wire Hoops, Twisted or Welded

	Off List
F.o.b. Pittsburgh	45 off
F.o.b. Chicago	43½ off

STEEL AND WROUGHT IRON PIPE AND TUBING

Welded Pipe

Base Discounts, f.o.b. Pittsburgh District and Lorain, Ohio, Mills

F.o.b. Pittsburgh only on wrought iron pipe.

Butt Weld

Steel Inches	Black	Galv.	*Wrought Iron* Inches	Black	Galv.
⅛	51½	29½	⅛	+91½	+138
¼ to ⅜	53½	35	¼ & ⅜	+1½	+21½
½	58½	47	½	31½	15
¾	62	52	¾	36½	20½
1 to 3	64	55	1 & 1¼	39½	25½
			1½	43½	28
			2	41½	26

Lap Weld

2	60	51	2	37	22½
2½ to 3	63	54	2½ to 3½	38	25
3½ to 6	65	56	4 to 8	40	28½
7 and 8	64	54	9 to 12	38	24½
9 and 10	63½	53½			
11 and 12	62½	52½			

Butt Weld, extra strong, plain ends

⅛	48½	33½	⅛	+13	+45½
¼ to ⅜	51	38	¼ & ⅜	+2½	+34½
½	56½	47½	½	32½	17½
¾	61	52	¾	37½	22½
1 to 3	63	55	1 to 2	43½	29

Lap Weld, extra strong, plain ends

2	58	50	2	40	26
2½ to 3	62	54	2½ to 4	45½	33
3½ to 6	65½	57½	4½ to 6	45	33½
7 and 8	64½	54½	7 & 8	46	33
9 and 10	63½	53½	9 to 12	41½	30
11 and 12	62½	52½			

On butt-weld steel pipe two extra 5% discounts are allowed on sales to consumers while three 5's off apply on sales to jobbers. On less-than-carload shipments prices are determined by adding 20 and 25% and the carload freight rate to the base card. On structural steel pipe the base card is reduced 2 points and two 5's off are allowed to consumers and three 5's off to jobbers.

Note—Chicago district mills have a base two points less than the above discounts. Chicago delivered base is 2½ points less. Freight is figured from Pittsburgh, Lorain, Ohio, and Chicago district mills, the billing being from the point producing the lowest price to destination.

Boiler Tubes

Seamless Steel Commercial Boiler Tubes and Locomotive Tubes

(Net base prices per 100 ft. f.o.b. Pittsburgh in carload lots)

		Cold Drawn	Hot Rolled
1 in. o.d.	13 B.W.G.	$ 8.60	$ 7.82
1¼ in. o.d.	13 B.W.G.	10.19	9.26
1½ in. o.d.	13 B.W.G.	11.26	10.23
1¾ in. o.d.	13 B.W.G.	12.81	11.64
2 in. o.d.	13 B.W.G.	14.35	13.04
2¼ in. o.d.	13 B.W.G.	16.00	14.54
2¼ in. o.d.	12 B.W.G.	17.61	16.01
2½ in. o.d.	12 B.W.G.	19.29	17.54
2¾ in. o.d.	12 B.W.G.	20.45	18.59
3 in. o.d.	12 B.W.G.	21.45	19.50
3½ in. o.d.	10 B.W.G.	41.08	37.35
3½ in. o.d.	11 B.W.G.	27.09	24.62
4 in. o.d.	10 B.W.G.	33.60	30.54
4½ in. o.d.	10 B.W.G.	41.08	37.35
5 in. o.d.	9 B.W.G.	51.56	46.87
6 in. o.d.	7 B.W.G.	79.15	71.90

Extras for less-carload quantities:

25,000 lb. or ft. to 39,999 lb. or ft.	5 %
12,000 lb. or ft. to 24,999 lb. or ft.	12½ %
6,000 lb. or ft. to 11,999 lb. or ft.	25 %
2,000 lb. or ft. to 5,999 lb. or ft.	35 %
Under 2,000 lb. or ft.	50 %

Lapweld Steel and Knobbled Charcoal Iron Pressure Tubes

(Net base prices per 100 ft. f.o.b. Pittsburgh, in carload lots)

		Steel	*Iron*
1½ in. o.d.	13 B.W.G.	$ 9.72	$20.16
1¾ in. o.d.	13 B.W.G.	11.06	21.84
2 in. o.d.	13 B.W.G.	12.38	17.23
2¼ in. o.d.	13 B.W.G.	13.79	19.58
2½ in. o.d.	12 B.W.G.	16.58	24.19
2¾ in. o.d.	12 B.W.G.	17.54	26.40
3 in. o.d.	12 B.W.G.	18.35	28.39
3¼ in. o.d.	11 B.W.G.	21.56	33.95
3½ in. o.d.	11 B.W.G.	23.15	36.16
4 in. o.d.	10 B.W.G.	28.66	45.36
4½ in. o.d.	10 B.W.G.	35.22	50.48
5 in. o.d.	9 B.W.G.	44.25	61.86
6 in. o.d.	7 B.W.G.	68.14	102.46

Quantity Extras:

40,000 lb. or ft.	base
25,000 lb. or ft. to 39,999 lb. or ft.	plus 5%
10,000 lb. or ft. to 24,999 lb. or ft.	plus 12½ %
2,000 lb. or ft. to 9,999 lb. or ft.	plus 25%
Under 2,000 lb. or ft.	plus 40%

CAST IRON WATER PIPE

	Per Net Ton
*6-in. and larger, del'd Chicago	$48.00
*4-in., del'd Chicago	51.40
6-in. and larger, del'd New York	45.20
4-in., del'd New York	48.20
*6 in. and larger, Birmingham	40.00
*4-in. Birmingham	43.00
6-in. and larger, f.o.b. dock, San Francisco or Los Angeles	48.00
F.o.b. dock, Seattle	48.50
4-in., f.o.b. dock, San Francisco or Los Angeles	51.00
F.o.b. dock, Seattle	51.50

Class "A" and gas pipe, $3 extra.

* Prices for lots of less than 200 tons. For 200 tons and over, 6-in. and larger is $39, Birmingham, and $47.40, delivered Chicago, and 4-in. pipe, $42, Birmingham, and $50.40 a ton, delivered Chicago.

RAILROAD MATERIALS

Rails and Track Supplies

F.o.b. Mill

Standard rails, heavier than 60 lb. per gross ton	$36.37½
Angle bars, per 100 lb.	2.55

F.o.b. Code Basing Points

Light rails (from billets) per gross ton	$35.00
Light rails (from rail steel) per gross ton	34.00

	Base per 100 Lb.
Spikes, 9/16 in. and larger	$2.60
Spikes, ½ and smaller	2.60
Tie plates, steel	1.90
Tie plates, Pacific Coast ports	2.00
Track bolts, to steam railroads	3.60
Track bolts, no jobbers, all sizes (per 100 counts)	70 per cent off list

Basing points on light rails are Pittsburgh, Chicago and Birmingham; on spikes and tie plates, Pittsburgh, Chicago, Buffalo, Portsmouth, Ohio, Weirton, W. Va., St. Louis, Kansas City, Minnequa, Colo., Birmingham and Pacific Coast ports; on tie plates alone, Steelton, Pa.; on spikes alone, Cleveland, Youngstown, Lebanon, Pa., Columbia, Pa., Richmond, Va.

BOLTS, NUTS, RIVETS AND SET SCREWS

Bolts and Nuts

(F.o.b. Pittsburgh, Cleveland, Birmingham or Chicago)

Per Cent Off List

Machine and carriage bolts: ½ in. x 6 in. and smaller..70, 10 and 5
Larger than ½ in.....70 and 10
Lag bolts .....70 and 10
Plow bolts, Nos. 1, 2, 3 and 7 heads .....70 and 10
Hot-pressed nuts, blank or tapped, square .....70 and 10
Hot-pressed nuts, blank or tapped, hexagon .....70 and 10
C.p.c. and t. square or hex. nuts, blank or tapped .....70 and 10
Semi-finished hexagon nuts, U.S.S. and S.A.E., all sizes to and incl. 1 in. diameter .....60, 20 and 15
Larger than 1 in. diameter.60, 20 and 15
Stove bolts in packages, Pittsburgh 72½ and 10
Stove bolts in packages, Chicago, 72½ and 10
Stove bolts in packages, Cleveland, 72½ and 10
Stove bolts in bulk, Pittsburgh.....82½
Stove bolts in bulk, Chicago.....82½
Stove bolts in bulk, Cleveland.....82½
Tire bolts 55

Large Rivets

(½-in. and larger)

Base per 100 Lb.

F.o.b. Pittsburgh or Cleveland.....$2.90
F.o.b. Chicago 3.00
F.o.b. Birmingham 3.05

Small Rivets

(7/16-in. and smaller)

Per Cent Off List

F.o.b. Pittsburgh .....70 and 5
F.o.b. Cleveland .....70 and 5
F.o.b. Chicago and Birm'g'm.....70 and 5

Cap and Set Screws

(Feight allowed up to but not exceeding 65c. per 100 lbs. on lots of 200 lb. or more)

Per Cent Off List

Milled cap screws, 1 in. dia. and smaller .....80, 10 and 10
Milled standard set screws, case hardened, 1 in. dia. and smaller..... 75
Milled headless set screws, cut thread ¾ in. and smaller 75
Upset hex. head cap screws, U.S.S. or S.A.E. thread, 1 in. and smaller.. 85
Upset set screws, cut and oval points .....75 and 10
Milled studs .....65 to 65 and 10

Alloy and Stainless Steel

Alloy Steel Ingots

F.o.b. Pittsburgh, Chicago, Canton, Massillon, Buffalo, Bethlehem, Uncropped .....$40 per gross ton

Alloy Steel Blooms, Billets and Slabs

F.o.b. Pittsburgh, Chicago, Canton, Massillon, Buffalo, Bethlehem.
Base price, $49 a gross ton.

Alloy Steel Bars

Price del'd Detroit is $52.
F.o.b. Pittsburgh, Chicago, Buffalo, Bethlehem, Massillon or Canton.
Open-hearth grade, base .....2.45c.
Delivered price at Detroit is.....2.60c.

S.A.E. Series Numbers	Alloy Differential per 100 lb.
2000 (½% Nickel)	$0.25
2100 (1½% Nickel)	0.55
2300 (3½% Nickel)	1.50
2500 (5% Nickel)	2.25
3100 Nickel Chromium	0.55
3200 Nickel Chromium	1.35
3300 Nickel Chromium	3.80
3400 Nickel Chromium	3.20
4100 Chromium Molybdenum (0.15 to 0.25 Molybdenum)	0.50
4100 Chromium Molybdenum (0.25 to 0.40 Molybdenum)	0.70
4600 Nickel Molybdenum (0.20 to 0.30 Molybdenum (1.50 to 2.00 Nickel)	1.05
5100 Chromium Steel (0.60 to 0.90 Chromium)	0.35
5100 Chromium Steel (0.80 to 1.10 Chromium)	0.45
5100 Chromium Spring Steel	base
6100 Chromium Vanadium Bar	1.10c.
6100 Chromium Vanadium Spring Steel	0.70
Chromium Nickel Vanadium	1.40
Carbon Vanadium	0.85

These prices are for hot-rolled steel bars. The differential for most grades in electric furnace steel is 50c. higher. The differential for cold-drawn bars ½c. per lb. higher with separate extras. Blooms, billets and slabs under 4x4 in. or equivalent are sold on the bar base. Slabs with a section area of 16 in. and 2½ in. thick or over take the billet base. Sections 4x4 in. to 10x10 in. or equivalent carry a gross ton price, which is the net price for bars for the same analysis. Larger sizes carry extras.

Alloy Cold-Finished Bars

F.o.b. Pittsburgh, Chicago, Gary, Cleveland or Buffalo. 2.95c. base per lb.

STAINLESS STEEL No. 302

(17 to 19% Cr. 7 to 9% NI. 0.08 to 0.20% C.)

(Base Prices f.o.b. Pittsburgh)

	Per Lb.
Forging billets	19.55c.
Bars	23c.
Plates	26c.
Structural shapes	23c.
Sheets	33c.
Hot-rolled strip	20¾c.
Cold-rolled strip	27c.
Drawn wire	23c.

Raw and Semi-Finished Steel

Billets, Blooms and Slabs

F.o.b. Pittsburgh, Chicago, Gary, Cleveland, Youngstown, Buffalo, Birmingham.

Per Gross Ton

Rerolling $29.00
Forging quality 35.00

Delivered Detroit

Rerolling $32.00
Forging 38.00

Billets Only F.o.b. Duluth

Rerolling $31.00
Forging 37.00

Sheet Bars

F.o.b. Pittsburgh, Chicago, Cleveland, Youngstown, Buffalo, Canton, Sparrows Point, Md.

Per Gross Ton

Open-hearth or Bessemer.....$30.00

Skelp

F.o.b. Pittsburgh, Chicago, Youngstown, Buffalo, Coatesville, Pa., Sparrows Point, Md.

Per Lb.

Grooved ..... 1.80c.
Universal ..... 1.80c.
Sheared ..... 1.80c.

Wire Rods

(Common, base)

Per Gross Ton

F.o.b. Pittsburgh $40.00
F.o.b. Cleveland 40.00
F.o.b. Chicago 41.00
F.o.b. Anderson, Ind 41.00
F.o.b. Youngstown 41.00
F.o.b. Worcester, Mass. 42.00
F.o.b. Birmingham 43.00
F.o.b. San Francisco 49.00
F.o.b. Galveston 46.00

Pig Iron and Ferroalloys

PIG IRON

PRICES PER GROSS TON AT BASING POINTS

Basing Points	No. 2 Fdry.	Malleable	Basic	Bessemer
Everett, Mass.	$20.50	$21.00	$20.00	$21.50
Bethlehem, Pa.	20.50	21.00	20.00	21.50
Birdsboro, Pa.	20.50	21.00	20.00	21.50
Swedeland, Pa.	20.50	21.00	20.00	21.50
Steelton, Pa.	....	....	20.00	....
Sparrows Point, Md.	20.50	....	20.00	....
Neville Island, Pa.	19.50	19.50	19.00	20.00
Sharpsville, Pa.	19.50	19.50	19.00	20.00
Youngstown	19.50	19.50	19.00	20.00
Buffalo	19.50	20.00	18.50	20.50
Erie, Pa.	19.50	20.00	19.00	20.50
Cleveland	19.50	19.50	19.00	20.00
Toledo, Ohio	19.50	19.50	19.00	20.00
Jackson, Ohio	21.25	21.25	20.75	....
Detroit	19.50	19.50	19.00	20.00
Hamilton, Ohio	19.50	19.50	19.00	20.00
Chicago	19.50	19.50	19.00	20.00
Granite City, Ill.	19.50	19.50	19.00	....
Duluth, Minn.	20.00	20.00	....	20.50
Birmingham	15.50	15.50	14.50	20.00
Provo, Utah	17.50	....	17.00	....

DELIVERED PRICES PER GROSS TON AT CONSUMING CENTERS

	No. 2 Fdry.	Malleable	Basic	Bessemer
Boston Switching District From Everett, Mass.	$21.00	$21.50	$20.50	$22.00
Brooklyn From East. Pa.	22.9289	23.4289	....	....
Newark or Jersey City, N. J. From East. Pa.	21.9873	22.4873	21.4873	22.9873
Philadelphia From Eastern Pa.	21.3132	21.8132	20.8132	22.3132
Cincinnati From Hamilton, Ohio	20.5807	20.5807	20.0807	21.0807
Canton, Ohio From Cleveland and Youngstown	20.8482	20.8482	20.3482	21.3482
Columbus, Ohio From Hamilton, Ohio	21.64	21.64	....	....
Mansfield, Ohio From Cleveland and Toledo	21.3832	21.3832	20.8832	21.8832
Indianapolis From Hamilton, Ohio	21.9289	21.9289	....	....
South Bend, Ind. From Chicago	21.6935	21.6935	....	....
Milwaukee From Chicago	20.57	20.57	....	....
St. Paul From Duluth	21.94	....	....	....
Davenport, Iowa From Chicago	21.3832	21.3832	....	....
Kansas City From Granite City	22.2178	22.2178	....	....
San Francisco, Los Angeles or Seattle. From Provo	22.315	....	....	....

Delivered prices on Southern iron for shipment to Northern points are 38c. a gross ton below delivered prices from the nearest Northern basing points.

LOW PHOSPHORUS PIG IRON

Basing points: Birdsboro, Pa., Steelton, Pa., and Standish, N. Y.....$24.00

GRAY FORGE PIG IRON

Valley furnace $19.00
Pittsburgh district furnace 19.00

CHARCOAL PIG IRON

Lake Superior furnace $22.00
Delivered Chicago 25.2528
Delivered Buffalo 25.595

CANADA

Pig Iron

Per gross ton:

Delivered Toronto

No. 1 fdy., sil. 2.25 to 2.75.....$21.00
No. 2 fdy., sil. 1.75 to 2.75..... 20.50
Malleable 22.50

Delivered Montreal

No. 1 fdy., sil. 2.25 to 2.75.....$22.50
No. 2 fdy., sil. 1.75 to 2.25..... 22.00
Malleable 22.50
Basic 22.00

FERROALLOYS

Ferromanganese

F.o.b. New York, Philadelphia, Baltimore, Mobile or New Orleans.

Per Gross Ton

Domestic, 80% (carload) $75.00

Spiegeleisen

Per Gross Ton Furnace

Domestic, 19 to 21%.....$26.00
50-ton lots 3-mo. shipment..... 24.00
F.o.b. New Orleans 26.00

Electric Ferrosilicon

Per Gross Ton Delivered

50% (carloads) $77.50
50% (ton lots) 85.00
75% (carloads) 120.00
75% (ton lots) 130.00

Silvery Iron

F.o.b. Jackson, Ohio, Furnace

Per Gross Ton		*Per Gross Ton*	
6.00 to 6.50%	$22.75	12%....	$29.75
6.51 to 7.00%	23.25	13%....	30.75
7.00 to 7.50%	23.75	14%....	32.25
7.51 to 8.00%	24.25	15%....	33.75
8.00 to 8.50%	24.75	16%....	35.25
8.51 to 9.00%	25.25	17%....	36.75
9.00 to 9.50%	25.75		
9.51 to 10.00%	26.25		
10.00 to 10.50%	26.75		
10.51 to 11.00%	27.25		
11.00 to 11.50%	27.75		
11.51 to 12.00%	28.25		

The lower all-rail delivered price from Jackson or Buffalo is quoted with freight allowed. Base prices at Buffalo are $1.25 a ton higher than at Jackson.

Manganese 2 to 3%, $1 a ton additional. For each unit of manganese over 3%, $1 a ton additional. Phosphorus 0.75% or over, $1 a ton additional.

Bessemer Ferrosilicon

F.o.b. Jackson, Ohio, Furnace

Per Gross Ton		*Per Gross Ton*	
10.00 to 10.50%	$27.75	13%....	$31.75
10.51 to 11.00%	28.15	14%....	33.25
11.00 to 11.50%	28.75	15%....	34.75
11.51 to 12.00%	29.25	16%....	36.25
12%	30.25	17%....	37.75

Manganese 2 to 3%, $1 a ton additional. For each unit of manganese over 3%, $1 a ton additional. Phosphorus 0.75% or over, $1 ton additional.

Base prices at Buffalo are $1.25 a ton higher than at Jackson.

Other Ferroalloys

Ferrotungsten, per lb. contained W, del., carloads $1.30
Ferrotungsten, lots of 5000 lb..... 1.35
Ferrotungsten, smaller lots 1.40
Ferrochromium, 4 to 6% carbon and up, 65 to 70% Cr per lb. contained Cr delivered, in car loads .....10.00c.
Ferrochromium, 2% carbon .....16.50c. to 17.00c.
Ferrochromium, 1% carbon .....17.50c. to 18.00c.
Ferrochromium, 0.10% carbon .....19.50c. to 20.00c.
Ferrochromium, 0.06% carbon .....20.00c. to 20.50c.
Ferrovanadium, del. per lb. contained V. .....$2.70 to $2.90
Ferrocolumbium, per lb. contained columbium, f.o.b. Niagara Falls, N. Y. $2.50
Ferrocarbontitanium, 15 to 18% Ti, 7 to 8% C, f.o.b. furnace carload and contract per net ton..$137.50
Ferrocarbontitanium, 17 to 20% Ti, 3 to 5% C, f.o.b. furnace, carload and contract, per net ton... 142.50
Ferrophosphorus, electric, or blast furnace material, in carloads, f.o.b. Anniston, Ala., for 18%, with $3 unitage, freight equalized with Rockdale, Tenn., per gross ton 58.50
Ferrophosphorus, electric, 24%, in carlots, f.o.b. Anniston, Ala., per gross ton with $3 unitage, freight equalized with Nashville, Tenn. 73.00
Ferromolybdenum, per lb. Mo. del. 95c.
Calcium molybdate, per lb. Mo. del. ..... 80c.
Silico spiegel, per ton, f.o.b. furnace, carloads $38.00
Ton lots or less, per ton..... 43.50
Silico-manganese, gross ton, delivered.
2.50% carbon grade $5.00
2% carbon grade 90.00
1% carbon grade 100.00
Spot prices .....$5 a ton higher

Iron and Steel Scrap

PITTSBURGH

Per gross ton delivered consumers' yards:

No. 1 heavy melting steel	$15.50 to $16.00
No. 2 heavy melting steel	14.00 to 14.50
No. 2 railroad wrought	15.50 to 16.00
Scrap rails	15.75 to 16.25
Rails, 3 ft. and under	16.50 to 17.00
Compressed sheet steel	15.50 to 16.00
Hand bundled sheet steel	14.00 to 14.50
Hvy. steel axle turnings	13.50 to 14.00
Machine shop turnings	10.50 to 11.00
Short shov. turnings	10.50 to 11.00
Short mixed borings and turnings	**8.50 to 9.50**
Cast iron borings	9.50 to 10.00
Cast iron carwheels	**14.00 to 14.50**
Heavy breakable cast	**12.50 to 13.00**
No. 1 cast	**14.00 to 14.50**
Malif. knuckles and couplers	17.25 to 17.75
Coil and leaf springs	17.25 to 17.75
Rolled steel wheels	17.25 to 17.75
Low phos. billet crops	17.50 to 18.00
Low phos. sheet bar crops	17.25 to 17.75
Low phos. punchings	16.75 to 17.25
Low phos. plate scrap	16.00 to 16.50
Steel car axles	15.75 to 16.25

CHICAGO

Delivered Chicago district consumers:

	Per Gross Ton
Heavy melting steel	$14.50 to $15.00
Automobile hvy. melt steel	12.50 to 13.00
Shoveling steel	14.50 to 15.00
Hydraulic comp. sheets	14.00 to 14.50
Drop forge flashings	11.50 to 12.00
No. 1 busheling	13.50 to 14.00
Rolled carwheels	16.00 to 16.50
Railroad tires	16.00 to 16.50
Railroad leaf springs	16.00 to 16.50
Axle turnings	13.00 to 13.50
Steel couplers and knuckles	16.00 to 16.50
Coil springs	16.25 to 16.75
Axle turnings (elec. fur.)	14.25 to 14.75
Low phos. punchings	17.00 to 17.50
Low phos. plates, 12 in. and under	16.75 to 17.25
Cast iron borings	7.50 to 8.00
Short shoveling turnings	10.25 to 10.75
Machine shop turnings	7.50 to 8.00
Steel rails less than 3 ft.	16.75 to 17.25
Steel rails, less than 2 ft.	17.50 to 18.00
Angle bars, steel	16.50 to 17.00
Cast iron carwheels	14.00 to 14.50
Railroad malleable	17.50 to 18.00
Agricultural malleable	14.50 to 15.00

	Per Net Ton
Iron car axles	$18.50 to $19.00
Steel car axles	15.50 to 16.00
No. 1 railroad wrought	13.00 to 13.50
No. 2 railroad wrought	12.75 to 13.25
No. 2 busheling, old	7.50 to 8.00
Locomotive tires, smooth	13.00 to 13.50
Pipes and flues	8.00 to 8.50
No. 1 machinery cast	13.50 to 14.00
Clean automobile cast	12.50 to 13.00
No. 1 railroad cast	12.50 to 13.00
No. 1 agricultural cast	10.75 to 11.25
Stove plate	8.50 to 9.00
Grate bars	9.50 to 10.00
Brake shoes	9.75 to 10.25

PHILADELPHIA

Per gross ton delivered consumers' yards:

No. 1 heavy melting steel	$13.50 to $14.00
No. 2 heavy melting steel	12.00 to 12.50
Hydraulic compressed, new	12.00 to 12.50
Hydraulic compressed, old	9.50 to 10.00
Steel rails for rolling	**14.50 to 15.00**
Cast iron carwheels	**14.50 to 15.00**
Heavy breakable cast	13.00 to 13.50
No. 1 cast	13.50 to 14.00
Stove plate (steel works)	10.50 to 11.00
Railroad malleable	16.50 to 17.00
Machine shop turnings	8.00 to 8.50
No. 1 blast furnace	6.25
Cast borings	6.00
Heavy axle turnings	10.25 to 11.75
No. 1 low phos. heavy	16.00 to 16.50
Couplers and knuckles	16.00 to 16.50
Rolled steel wheels	16.00 to 16.50
Steel axles	16.50 to 17.00
Shafting	18.25 to 18.75
No. 1 railroad wrought	13.00 to 13.50
Spec. iron and steel pipe	10.50 to 11.00
Bundled sheets	11.00 to 11.50
No. 1 forge fire	12.00 to 12.50
Cast borings (chem.)	10.50 to 13.00

CINCINNATI

Dealers' buying prices per gross ton:

No. 1 heavy melting steel	$11.50 to $12.00
No. 2 heavy melting steel	9.50 to 10.00
Scrap rails for melting	11.00 to 11.50
Loose sheet clippings	7.50 to 8.00
Bundled sheets	8.50 to 9.00
Cast iron borings	6.50 to 7.00
Machine shop turnings	7.25 to 7.75
No. 1 busheling	9.00 to 9.50
No. 2 busheling	4.75 to 5.25
Rails for rollings	11.50 to 12.00
No. 1 locomotive tires	10.00 to 10.50
Short rails	14.50 to 15.00
Cast iron carwheels	11.00 to 11.50
No. 1 machinery cast	12.00 to 12.50
No. 1 railroad cast	11.25 to 11.75
Burnt cast	8.25 to 8.75
Stove plate	8.25 to 8.75
Agricultural malleable	10.25 to 10.75
Railroad malleable	12.00 to 12.50

CLEVELAND

Per gross ton delivered consumers' yards:

No. 1 heavy melting steel	$14.50 to $15.00
No. 2 heavy melting steel	13.50 to 14.00
Compressed sheet steel	14.00 to 14.50
Light bundled sheet stampings	11.00 to 11.50
Drop forge flashings	13.50 to 14.00
Machine shop turnings	8.00 to 8.50
Short shoveling turnings	8.75 to 9.00
No. 1 busheling	13.50 to 14.00
Steel axle turnings	12.50 to 13.00
Low phos. billet crops	17.50 to 18.00
Cast iron borings	8.75 to 9.00
Mixed borings and short turnings	8.75 to 9.00
No. 2 busheling	8.75 to 9.00
No. 1 cast	15.00 to 15.50
Railroad grate bars	8.00 to 8.50
Stove plate	9.00 to 9.50
Rails under 3 ft.	17.50 to 18.00
Rails for rolling	15.50 to 16.00
Railroad malleable	16.50 to 17.00
Cast iron carwheels	.... 15.00

BUFFALO

Per gross ton, f.o.b. Buffalo consumers' plants:

No. 1 heavy melting steel	$13.00 to $13.50
No. 2 heavy melting scrap	12.00 to 12.50
Scrap rails	13.00 to 13.50
New hydraul. comp. sheets	12.00 to 12.50
Old hydraul. comp. sheets	11.00 to 11.50
Drop forge flashings	12.00 to 12.50
No. 1 busheling	12.00 to 12.50
Hvy. steel axle turnings	11.25 to 11.75
Machine shop turnings	8.00 to 8.50
Knuckles and couplers	15.00 to 15.50
Coil and leaf springs	15.00 to 15.50
Rolled steel wheels	15.00 to 15.50
Low phos. billet crops	14.50 to 15.00
Short shov. steel turnings	8.25 to 8.75
Short mixed borings and turnings	8.25 to 8.75
Cast iron borings	8.25 to 8.75
No. 2 busheling	.... 7.00
Steel car axles	12.50 to 13.00
Iron axles	12.50 to 13.00
No. 1 machinery cast	12.50 to 13.00
No. 1 cupola cast	11.50 to 12.00
Stove plate	10.00 to 10.50
Steel rails, 3 ft. and under	14.50 to 15.00
Cast iron carwheels	12.00 to 12.50
Railroad malleable	16.25 to 16.75
Chemical borings	9.00 to 9.50

BOSTON

Dealers' buying prices per gross ton:

*No. 1 heavy melting steel	$10.75 to $11.00
No. 1 heavy melting steel	.... 9.75
*Scrap rails	10.75 to 11.00
Scrap rails	8.75 to 9.00
*No. 2 steel	9.75 to 10.00
No. 2 steel	8.75 to 9.00
Breakable cast	.... 8.25
*Machine shop turnings	5.50 to 5.75
Machine shop turnings	4.25 to 4.50
Bundled skeleton, long	7.25 to 7.65
Shafting	13.50 to 13.75
Engine blocks, stripped	8.00 to 8.50
Cast iron borings, chemical	5.00 to 7.00
Cotton ties	.... **6.00**
*Stove plate	.... 7.00

Per gross ton delivered consumers' yards:

Textile cast	$10.00 to $10.25
No. 1 machinery cast	10.00 to 10.50
Stove plate	6.50 to 7.00

* Delivered local army base.

NEW YORK

Dealers' buying prices per gross ton:

No. 1 heavy melting steel	†$9.25 to *$10.00
No. 2 heavy melting steel	†8.25 to *9.00
Heavy breakable cast	.... 9.00 to 9.50
No. 1 machinery cast	.... 9.50 to 10.00
No. 2 cast	†7.75 to *8.75
Stove plate	†7.00 to *7.50
Steel car axles	13.50 to 14.00
Shafting	13.50 to 13.75
No. 1 railroad wrought	9.50 to 10.00
No. 1 yard wrought long	8.50 to 9.00
Spec. iron and steel pipe	7.50 to 8.00
Forge fire	7.50 to 8.00
Rails for rollings	11.00 to 12.00
Short shoveling turnings	5.00 to 5.50
Machine shop turnings	4.50 to 5.00
Cast borings	4.50 to 5.00
No. 1 blast furnace	3.00 to 3.50
Cast borings (chemical)	10.00 to 11.00
Unprepared yard iron and steel	5.50 to 6.00

Per gross ton, delivered local foundries:

No. 1 machinery cast	.... $11.50
No. 1 hvy. cast (cupola size)	.... 9.50
No. 2 cast	.... 8.00

† Loading on barge.
*50c. higher offered at nearby New Jersey points.

BIRMINGHAM

Per gross ton delivered consumers' yards:

Heavy melting steel	$9.50 to $10.00
Scrap steel rails	11.00 to 11.50
Short shoveling turnings	.... 7.00
Stove plates	.... 7.00
Steel axles	11.50 to 12.00
Iron axles	.... 11.50
No. 1 railroad wrought	.... 8.50
Rails for rolling	.... 12.50
No. 1 crst	10.50 to 11.00
Tramcar wheels	10.00 to 10.50

ST. LOUIS

Dealers' buying prices per gross ton delivered consumers' works:

Selected heavy steel	$12.50 to $13.00
No. 1 heavy melting	12.50 to 13.00
No. 2 heavy melting	11.00 to 11.50
No. 1 locomotive tires	11.00 to 11.50
Misc. stand-sec. rails	13.00 to 13.50
Railroad springs	12.00 to 12.50
Bundled sheets	9.50 to 10.00
No. 2 railroad wrought	12.50 to 13.00
No. 1 busheling	7.50 to 8.00
Cast iron borings and shoveling turnings	4.50 to 5.00
Rails for rolling	13.75 to 14.25
Machine shop turnings	4.00 to 4.50
Heavy turnings	9.25 to 9.75
Steel car axles	13.00 to 13.50
Iron car axles	15.00 to 16.00
No. 1 railroad wrought	10.50 to 11.00
Steel rails less than 3 ft.	13.50 to 14.00
Steel angle bars	13.00 to 13.50
Cast iron carwheels	11.00 to 11.50
No. 1 machinery cast	11.25 to 11.75
Railroad malleable	14.25 to 14.75
No. 1 railroad cast	11.25 to 11.75
Stove plate	7.50 to 8.00
Agricult. malleable	12.50 to 13.00

DETROIT

Dealers' buying prices per gross ton:

No. 1 heavy melting steel	$11.50 to $12.00
No. 2 heavy melting steel	$10.75 to $11.25
Borings and turnings	7.00 to 7.50
Long turnings	6.50 to 7.00
No. 1 machinery cast	14.00 to 14.50
Automotive cast	14.00 to 14.50
Hydraulic comp. sheets	11.75 to 12.25
Stove plate	8.75 to 9.25
New factory busheling	10.50 to 11.00
Old No. 2 busheling	6.00 to 6.50
Sheet clippings	9.00 to 9.50
Flashings	10.75 to 11.25
Low phos. plate scrap	11.75 to 12.25

CANADA

Dealers' buying prices per gross ton:

	Toronto	Montreal
Heavy melting steel	$7.50	$7.00
Rails, scrap	8.50	8.00
Machine shop turnings	4.00	4.00
Boiler plate	7.00	6.00
Heavy axle turnings	4.50	4.00
Cast borings	5.00	4.50
Steel borings	4.00	4.00
Wrought pipe	4.00	4.00
Steel axles	8.50	9.00
Axles, wrought iron	9.00	9.50
No. 1 machinery cast	11.50	11.00
Stove plate	7.50	7.00
Standard carwheels	11.00	10.50
Malleable	7.00	7.00
Shoveling steel	6.50	6.00
Bushelings	6.00	5.50
Compressed sheets	6.50	6.00

ORES, FLUORSPAR, COKE, FUEL, REFRACTORIES

Lake Superior Ores

Delivered Lower Lake Ports

	Per Gross Ton
Old range, Bessemer, 51.50% iron	$4.80
Old range, non-Bessemer, 51.50% iron	4.65
Mesabi, Bessemer 51.50% iron	4.65
Mesabi, non-Bessemer, 51.50% iron	4.50
High phosphorus, 51.50% iron	4.40

Foreign Ore

C.i.f. Philadelphia or Baltimore

	Per Unit
Iron, low phos., copper free, 55 to 58% iron dry Spanish or Algeria	10.25c.
Iron, low phos., Swedish, average 68½% iron	10.25c.
Iron, basic or foundry, Swedish, aver. 65% iron	9.50c.
Iron, basic or foundry, Russian, aver. 65% iron	Nominal
Manganese, Caucasian, washed 52%	26c.
Manganese, African, Indian, 44-48%	25c.
Manganese, African, Indian, 49-51%	26c.
Manganese, Brazilian, 46 to 48½%	24c.

	Per Net Ton Unit
Tungsten, Chinese, wolframite, duty paid, delivered	$16.00
Tungsten, domestic, scheelite delivered	16.00

	Per Gross Ton
Chrome, 45% Cr_2O_3, lump, c.i.f. Atlantic Seaboard (African)	$17.50
45 to 46% Cr_2O_3 (Turkish)	$16.50 to $17.00
48% Cr_2O_3 (African)	20.50
48% min. Cr_2O_3 (Turkish)	19.25
Chrome concentrate, 50% and over Cr_2O_3, c.i.f. Atlantic Seaboard	22.00
52% Cr_2O_3 (Turkish)	21.75
48 to 49% Cr_2O_3 (Turkish)	19.25

Fluorspar

	Per Net Ton
Domestic, washed gravel, 85-5, f.o.b. Kentucky and Illinois mines for all rail shipment	$17.50
No. 2 lump, 85-5, f.o.b. Kentucky and Illinois mines	18.00
Foreign, 85% calcium fluoride, not over 5% silicon, c.i.f. Atlantic ports, duty paid	20.00
Domestic No. 1 ground bulk, 95 to 98% calcium fluoride, not over 2½% silicon, f.o.b. Illinois and Kentucky mines	30.00

COKE, COAL AND FUEL OIL

Coke

	Per Net Ton
Furnace, f.o.b. Connellsville Prompt	$3.65 to $3.80
Foundry, f.o.b. Connellsville Prompt	4.25 to 5.75
Foundry, by-product, Chicago ovens, for delivery outside switching district	9.00
Foundry, by-product, delivery in Chicago switching district	9.75
Foundry, by-product, New England, delivered	11.50
Foundry, by-product, Newark or Jersey City, del'd	9.65
Foundry, by-product, Phila.	9.38
Foundry, by-product, Cleveland, delivered	9.75
Foundry, by-product, Cincinnati, del'd	9.50
Foundry, Birmingham	$6.50
Foundry, by-product, St. Louis, f.o.b. ovens	8.00
Foundry, by-product, del'd St. Louis	9.00
Foundry, from Birmingham, f.o.b. cars docks, Pacific ports	14.75

Coal

	Per Net Ton
Mine run steam coal, f.o.b. W. Pa. mines	$1.50 to $1.75
Mine run coking coal, f.o.b. W. Pa.	1.90 to 2.10
Gas coal, ¾-in. f.o.b. Pa. mines	2.00 to 2.25
Mine run gas coal, f.o.b. Pa. mines	1.80 to 2.00
Steam slack, f.o.b. W. Pa. mines	1.00 to 1.25
Gas slack, f.o.b. W. Pa. mines	1.20 to 1.45

Fuel Oil

	Per Gal. f.o.b. Bayonne, N. J.
No. 3 distillate	4.25c.
No. 4 industrial	3.87½c.

	Per Gal. f.o.b. Baltimore
No. 3 distillate	4.25c.
No. 4 industrial	3.87½c.

	Per Gal del'd Chicago
No. 3 industrial fuel oil	5.00c.
No. 5 industrial fuel oil	3.77c.

	Per Gal. f.o.b. Cleveland
No. 3 distillate	6.00c.
No. 4 industrial	5.75c.
No. 5 industrial	5.00c.

REFRACTORIES

Fire Clay Brick

	Per 1000 f.o.b. Works	
	High-heat Duty Brick	Intermediate Duty Brick
Pennsylvania	$45.00	$40.00
Maryland	45.00	40.00
New Jersey	50.00	43.00
Ohio	40.00	35.00
Kentucky	45.00	40.00
Missouri	45.00	40.00
Illinois	45.00	40.00
Ground fire clay, per ton	7.00	

Silica Brick

	Per 1000 f.o.b. Works
Pennsylvania	$45.00
Chicago District	54.00
Birmingham	$48.00 to 50.00
Silica cement per net ton	8.00

Chrome Brick

	Per Net Ton
Standard f.o.b. Baltimore, Plymouth Meeting and Chester, Pa.	$45.00
Chemically bonded f.o.b. Baltimore, Plymouth Meeting and Chester, Pa.	45.00

Magnesite Brick

	Per Net Ton
Standard, f.o.b. Baltimore and Chester, Pa.	$85.00
Chemically bonded, f.o.b. Baltimore	55.00

Grain Magnesite

	Per Net Ton
Imported, f.o.b. Baltimore and Chester, Pa. (in sacks)	$45.00
Domestic, f.o.b. Baltimore and Chester, in sacks	40.00
Domestic, f.o.b. Chewelah, Wash.	22.00

Warehouse Prices for Steel Products

PITTSBURGH

	Base per Lb.
Plates	3.15c.
Structural shapes	3.15c.
Soft steel bars and small shapes	2.95c.
Reinforcing steel bars	2.90c.
Cold-finished and screw stock:	
Rounds and hexagons	3.35c.
Squares and flats	3.35c.
Hoops and bands under ¼ in.	3.20c.
Hot-rolled annealed sheets (No. 24), 25 or more bundles	3.30c.
Galv. sheets (No. 24), 25 or more bundles	3.95c.
Hot-rolled sheets (No. 10)	2.95c.
Galv. corrug. sheets (No. 28), per square (more than 3750 lb.)	$3.69
Spikes, large	2.90c.
Track bolts, all sizes, per 100 count, 65 per cent off list.	
Machine bolts, 100 count, 65 per cent off list.	
Carriage bolts, 100 count, 65 per cent off list.	
Nuts, all styles, 100 count, 65 per cent off list.	
Large rivets, base per 100 lb.	$3.50
Wire, black, soft ann'l'd, base per 100 lb	2.65c.
Wire, galv. soft, base per 100 lb.	3.00c.
Common wire nails, per keg	2.60c.
Cement coated nails, per keg	2.60c.

On plates, structurals, bars, reinforcing bars, bands, hoops and blue annealed sheets, base applies to orders of 400 to 9999 lbs.

*Delivered in Pittsburgh switching district.

CHICAGO

	Base per Lb.
Plates and structural shapes	3.20c.
Soft steel bars, rounds	3.00c.
Soft steel bars, squares and hexagons	3.15c.
Cold-fin. steel bars:	
Rounds and hexagons	3.50c.
Flats and squares	3.50c.
Hot-rolled strip	3.30c.
Hot-rolled annealed sheets (No. 24)	3.85c.
Galv. sheets (No. 24)	4.55c.
Hot-rolled sheets (No. 10)	3.05c.
Spikes (keg lots)	3.50c.
Track bolts (keg lots)	4.65c.
Rivets, structural (keg lots)	3.65c.
Rivets, boiler (keg lots)	3.75c.
	Per Cent Off List
Machine bolts	*70
Carriage bolts	*70
Lag screws	*70
Hot-pressed nuts, sq. tap or	
Hot-pressed nuts, sq. tap or blank	*70
Hot-pressed nuts, hex. tap or	
Hot-pressed nuts, hex. tap or blank	*70
Hex. head cap screws	87½
Cut point set screws	75 and 10
Flat head bright wood screws	70
Spring cotters	55
Stove bolts in full packages	70
Rd. hd. tank rivets, 7/16 in. and smaller	57½
Wrought washers	$4.50 off list
Black ann'l'd wire per 100 lb.	$3.85
Com. wire nails, base per keg	2.95†
Cement c't'd nails, base per keg	2.95†

On plates, shapes, bars, hot-rolled strip and heavy hot-rolled sheets, the base applies on orders of 400 to 9999 lb. All prices are f.o.b. consumers' plants within the Chicago switching district.

*These are quotations delivered to city trade for quantities of 100 lb. or more. For lots of less than 100 lb., the quotation is 65 per cent off. Discounts applying to country trade are 70 per cent off, f.o.b. Chicago, with full or partial freight allowed up to 50c. per 100 lb.

†Prices for city and suburbs only.

NEW YORK

	Base per Lb.
Plates, ¼ in. and heavier	3.40c.
Structural shapes	3.37c.
Soft steel bars, rounds	3.31c
Iron bars	3.31c.
Iron bars, swed. charcoal	6.75c. to 7.00c.
Cold-fin. shafting and screw stock:	
Rounds and hexagons	3.81c.
Flats and squares	3.81c.
Cold-rolled: strip, soft and quarter hard	3.36c.
Hoops	3.56c.
Bands	3.56c.
Hot-rolled sheets (No. 10)	3.31c.
Hot-rolled ann'l'd sheets (No. 24*)	3.89c.
Galvanized sheets (No. 24*)	special
Long terne sheets (No. 24)	5.25c.
Standard tool steel	11.00c.
Wire, black annealed (No. 10)	3.40c.
Wire, galv. (No. 10)	3.75c.
Tire steel, 1 x ½ in. and larger	3.75c.
Open hearth spring steel	4.00c. to 10.00c.
Common wire nails, base, per keg	$3.21
	Per Cent Off List
Machine bolts, square head and nut:	
All diameters	65 and 10
Carriage bolts, cut thread:	
All diameters	65 and 10
Boiler tubes:	Per 100 Ft.
Lap welded, 2-in.	$18.05
Seamless welded, 2-in.	19.24
Charcoal iron, 2-in.	24.94
Charcoal iron, 4-in.	63.65

*No. 28 and lighter, 36 in. wide, 20c. higher per 100 lb.

ST. LOUIS

	Base per Lb.
Plates and struc. shapes	3.45c.
Bars, soft steel (rounds and flats)	3.25c.
Bars, soft steel (squares, hexagons, ovals, half ovals and half rounds)	3.40c.
Cold-fin. rounds, shafting, screw stock	3.75c.
Hot-rolled annealed sheets (No. 24)	4.10c.
Galv. sheets (No. 24)	4.65c.
Hot-rolled sheets (No. 10)	3.30c.
Black corrug. sheets (No. 24)	4.10c.
*Galv. corrug. sheets	4.65c.
Structural rivets	4.00c.
Boiler rivets	4.10c.
	Per Cent Off List
Tank rivets, 7/16 in. and smaller	55
Machine and carriage bolts, lag screws, fitting up bolts, bolt ends, plow bolts, hot-pressed nuts, square and hexagon, tapped or blank, semi-finished nuts: All quantities	70

*No. 26 and lighter take special prices.

PHILADELPHIA

	Base per Lb.
*Plates, ¼-in. and heavier	2.98c.
*Structural shapes	2.98c.
*Soft steel bars, small shapes, iron bars (except bands)	3.03c.
‡Reinforc. steel bars, sq. twisted and deformed	2.96c.
Cold-finished steel bars	3.76c.
*Steel hoops	3.43c.
*Steel bands, No. 12 and 3/16 in. incl.	3.18c.
Spring steel	5.00c.
†Hot-rolled anneal. sheets (No. 24)	3.65c.
†Galvanized sheets (No. 24)	4.40c.
*Hot-rolled annealed sheets (No. 10)	3.08c.
Diam. pat. floor plates, ¼ in.	4.95c.
Swedish iron bars	6.25c.

These prices are subject to quantity differentials except on reinforcing and Swedish iron bars.

*Base prices subject to deduction on orders aggregating 4000 lb. or over.

†For 50 bundles or over.

‡For less than 2000 lb.

CLEVELAND

	Base per Lb.
Plates and struc. shapes	3.31c.
Soft steel bars	3.00c.
Reinforc. steel bars	2.10c.
†Cold-finished steel bars	3.50c.
Flat-rolled steel under ¼ in.	3.36c.
Cold-finished strip	†3.00c.
Hot-rolled annealed sheets (No. 24)	3.91c.
Galvanized sheets (No. 24)	4.61c.
Hot-rolled sheets (No. 10)	3.11c.
Hot-rolled 3/16 in. 24 to 48 in. wide sheets	3.56c.
*Black ann'l'd wire, per 100 lb.	$2.45
*No. 9 galv. wire, per 100 lb.	2.80
*Com. wire nails, base per keg	2.40

†Outside delivery 10c. less.

*For 5000 lb. or less.

CINCINNATI

	Base per Lb.
Plates and struc. shapes	3.42c.
Bars, rounds, flats and angles	3.22c.
Other shapes	3.37c.
Rail steel reinforc. bars	3.25c.
Hoops and bands, 3/16 in. and lighter	3.47c.
Cold-finished bars	3.72c.
Hot-rolled annealed sheets (No. 24)	4.02c.
Galv. sheets (No. 24)	4.72c.
Hot-rolled sheets (No. 10)	3.22c.
Structural rivets	4.35c.
Small rivets	55 per cent off list
No. 9 ann'l'd wire, per 100 lb. (1000 lb. or over)	$2.88
Com. wire nails, base per keg:	
Any quantity less than carload	3.04
Cement c't'd nails, base 100-lb. keg	3.50
Chain, lin. per 100 lb.	8.35
	Net per 100 Ft.
Seamless steel boiler tubes, 2-in.	$20.37
4-in.	48.14
Lap-welded steel boiler tubes, 2-in.	19.38
4-in.	45.32

BUFFALO

	Base per Lb.
Plates	3.38c.
Struc. shapes	3.25c.
Soft steel bars	3.05c.
Reinforcing bars	2.60c.
Cold-fin. flats and sq.	3.55c.
Rounds and hex.	3.55c.
Cold-rolled strip steel	3.19c.
Hot-rolled annealed sheets (No. 24)	4.06c.
Heavy hot-rolled sheets (3/16 in., 24 to 48 in. wide)	3.63c.
Galv. sheets (No. 24)	4.70c.
Bands	3.43c.
Hoops	3.43c.
Heavy hot-rolled sheets	3.18c.
Com. wire nails, base per keg	$3.15
Black wire, base per 100 lb. (2500-lb. lots or under)	3.50
(Over 2500 lb.)	3.40

BOSTON

	Base per Lb.
Beams, channels, angles, tees, zees	3.54c.
H beams and shapes	3.54c.
Plates—Sheered, tank and univ. mill, ¼ in. thick and heavier	3.56c.
Floor plates, diamond pattern	5.36c.
Bar and bar shapes (mild steel)	3.45c.
Bands 3/16 in. thick and No. 12 ga. incl.	3.65c. to 4.65c
Half rounds, half ovals, ovals and bevels	4.70c.
Tire steel	4.70c.
Cold-rolled strip steel	3.245c.
Cold-finished rounds, squares and hexagons	3.90c.
Cold-finished flats	3.90c.
Blue annealed sheets, No. 10 ga.	3.65c.
One pass cold-rolled sheets No. 24 ga.	4.20c.
Galvanized steel sheets, No. 24 ga.	4.90c.
Lead coated sheets, No. 24 ga.	5.85c.

Prices delivered by truck in metropolitan Boston, subject to quantity differentials.

DETROIT

	Base per Lb.
Soft steel bars	3.09c.
Structural shapes	3.42c
Plates	3.42c.
Floor plates	5.17c.
Hot-rolled annealed sheets (No. 24)	3.94c.
Hot-rolled sheets (No. 10)	3.14c.
Galvanized sheets (No. 24)**	4.72c.
Bands	3.39c.
Hoops	3.39c.
†Cold-finished bars	3.64c.
Cold-rolled strip	3.18c.
Hot-rolled alloy steel (S.A.E. 3100 Series)	5.29c.*
Bolts and nuts, in cases,	70 and 10 per cent off list
Broken cases	70 per cent off

Prices delivered by truck in metropolitan Detroit, subject to quantity differentials.

*Price applies to 1,000 lb. and over.

†With reduction in chemical extras.

**0.25c. off list for 10 to 25 bundles; 0.50c. for 25 bundles and over. Detroit delivery only.

MILWAUKEE

	Base per Lb.
Plates and structural shapes	3.31c.
Soft steel bars, rounds up to 8 in., flats and fillet angles	3.11c.
Soft steel bars, squares and hexagons	3.26c.
Hot-rolled strip	3.41c.
Hot-rolled sheets (No. 10)	3.16c.
Hot-rolled annealed sheets (No. 24)	3.96c.
Galvanized sheets (No. 20)	4.66c.
Cold-finished steel bars	3.61c.
Cold-rolled strip	3.33c.
Structural rivets (keg lots)	3.86c.
Boiler rivets, cone head (keg lots)	3.96c.
Track spikes (keg lots)	3.71c.
Track bolts (keg lots)	4.86c.
Black annealed wire	3.15c.
Com. wire nails	2.85c.
Cement coated nails	2.85c.
	Per Cent Off List
Machine bolts	70 and 10
Carriage bolts	70 and 10
Hot-pressed nuts, sq. and hex. tapped or blank (keg lots)	70 and 10

Prices given above are delivered Milwaukee.

On plates, shapes, bars, hot-rolled strip and heavy hot-rolled sheets, the base applies on orders of 400 to 9999 lb. On galvanized and No. 24 hot-rolled annealed sheets the prices given apply on orders of 400 to 1500 lb. On cold-finished bars the prices are for orders of 1000 lb. or more of a size.

ST. PAUL

	Base per Lb.
Mild steel bars, rounds	3.25c.
Structural shapes	3.45c.
Plates	3.45c.
Cold-finished bars	4.02c.
Bands and hoops	3.55c.
Hot-rolled annealed sheets, No. 24	3.90c.
Galvanized sheets, No. 24	4.50c.
Cold-rolled sheets, No. 20	4.95c.

On mild steel bars, shapes, plates and hoops and bands the base applies on 400 to 14,999 lb. On hot-rolled sheets, galvanized sheets and cold-rolled sheets base applies on 15,000 lb. and over. Base on cold-finished bars is 1000 lb. and over of a size.

BALTIMORE

	Base per Lb.
*Mild steel bars	3.00c.
**Reinforcing bars	2.85c.
*Structural shapes	3.00c.
†Plates	3.00c.
†Hot-rolled sheets, No. 10	3.10c.
‡Hot-rolled annealed sheets, No. 24	3.60c.
‡Galvanized sheets, No. 24	4.30c.
*Bands	3.20c.
*Hoops	3.45c.
§Cold-rolled rounds	3.58c.
§Cold-rolled squares, hex. and flats	3.58c.
Rivets	4.40c.
Bolts and nuts, per cent off list	60 and 10

*Quantity extras per size apply. †Quantity extras per thickness apply. Hot-rolled quantity extras are: 2000 lb. and over, base; 1500 lb. to 1999 lb. add 15c. per 100 lb.; 1000 lb. to 1499 lb., add 30c.; 0 to 999 lb., add 50c.

‡25 bundles and over, base. For 1 to 9 bundles add 50c. per 100 lb.; for 10 to 24 bundles add 25c.

§Base for 1000 lb. and over. For 500 to 999 lb. add 25c. per 100 lb.; for 300 to 499 lb. add $1.00; for 0 to 299 lb. add $1.75; for combined order under 100 lb. add $3.00.

**For orders 4000 lb. to 9999 lb. Add 15c. per 100 lb. for orders 2000 to 3999 lb.; add 65c. for orders less than 2000 lb.

CHATTANOOGA

	Base per Lb.
Mild steel bars	3.36c.
Iron bars	3.36c.
Reinforcing bars	3.36c.
Structural shapes	3.56c.
Plates	3.56c.
Hot-rolled sheets, No. 10	3.36c.
Hot-rolled annealed sheets, No. 24	4.16c.
Galvanized sheets, No. 24	4.86c.
Steel bands	3.61c.
Cold-finished bars	3.98c.

MEMPHIS

	Base per Lb.
Mild steel bars	3.47c.
Shapes, bar size	3.47c.
Iron bars	3.47c.
Structural shapes	3.67c.
Plates	3.67c.
Hot-rolled sheets, No. 10	3.47c.
Hot-rolled annealed sheets, No. 24	4.27c.
Galvanized sheets, No. 24	4.80c.
Steel bands	3.72c.
Cold-drawn rounds	3.89c.
Cold-drawn flats, squares, hexagons	5.89c.
Structural rivets	4.25c.
Bolts and nuts, per cent off list	65
Small rivets, per cent off list	50

NEW ORLEANS

	Base per Lb.
Mild steel bars	3.35c.
Reinforcing bars	3.50c.
Structural shapes	3.55c.
Plates	3.55c.
Hot-rolled sheets, No. 10	3.55c.
Hot-rolled annealed sheets, No. 24	4.50c.
Galvanized sheets, No. 24	4.95c.
Steel bands	3.95c.
Cold-finished steel bars	4.30c.
Structural rivets	4.25c.
Boiler rivets	4.25c.
Common wire nails, base per keg	$2.95
Bolts and nuts, per cent off list	70

PACIFIC COAST

	Base per Lb. San Francisco	Los Angeles	Seattle
Plates, tank and U. M.	3.25c.	3.60c.	3.55c.
Shapes, standard	3.25c.	3.60c.	3.55c.
Soft steel bars	3.25c.	3.60c.	3.70c.
Reinforcing bars, f.o.b. cars dock Pacific ports	2.45c.	2.45c.	2.45c.
Hot-rolled annealed sheets (No. 24)	4.00c.	4.35c.	4.40c.
Hot-rolled sheets (No. 10)	3.35c.	3.70c.	3.75c.
Galv. sheets (No. 24)	4.50c.	4.95c.	5.00c.
Cold finished steel Rounds	5.80c.	5.85c.	6.00c.
Squares and hexagons	7.05c.	7.10c.	7.25c.
Flats	7.55c.	7.60c.	8.25c.
Common wire nails—base per keg less carload	$3.20	$3.20	$3.30

All items subject to differentials for quantity.

TOOL STEEL

Prices are same for warehouse distribution at all points on or East of Mississippi River. West of Mississippi quotations are 1c. a lb. higher.

	Base per Lb.
High speed	57c.
High carbon chrome	37c.
Oil hardening	22c.
Extra	17c.
Regular	14c.

Automotive Orders Up Slightly at Cleveland

Steel Production Maintained as Refrigerator and Stove Makers Order More Freely—Prices Still Weak

CLEVELAND, Feb. 25.—Orders for sheets from the motor car manufacturers have improved slightly. While they are for small lots, they provide some encouragement for the belief that there will be a fair uptrend shortly in the demand for steel from the automobile industry.

Ingot output in the Cleveland-Lorain district is unchanged this week at 66 per cent of capacity. Finishing mill operations are irregular but the average production by sheet and strip mills has been reduced. These mills have little backlog tonnage.

The outlook in the steel industry has been improved by the passing of the extremely cold weather which has hampered activities in about every metal-working industry. Manufacturers of refrigerators are getting under good operation on new models and good orders for sheets are coming from that source. Demand is also good from the stove industry and makers of other household equipment. Railroads in this territory are limiting their purchases to small lots of steel for repair work. No announcements on prices for the second quarter have as yet been made. With concessions of $3 a ton quite common on hot and cold-rolled and galvanized sheets and on strip steel, there is some talk that the official prices on those products will be reduced to meet the present rather general selling prices for current orders only. Prices for the second quarter will thus be left open for further action later. Extreme price weakness on wire products is still in evidence with minimum concessions of $6 a ton on nails and annealed and galvanized wire. Manufacturers' wire is firm at the regular price.

Pig Iron

Shipments show a slight gain and a further improvement is looked for in March. Sales continue light. Demand from makers of heating equipment is heavy and helps offset the decreased specifications from motor car foundries. Some melters are using more pig iron in their mixtures than recently because of the high price of scrap. One producer has announced that all fourth quarter contracts must be cleaned up by March 31. If the iron is not taken out by that date the contract will be cancelled and the buyer will be asked to make a new contract at the higher prices now prevailing. With the reaffirming of present prices for the second quarter, furnaces look for a moderate volume of activity in contracts. Foundry coke shipments in February have gained 25 per cent over January but the increase is partly attributed to the desire of consumers to enlarge their stocks because of the possibility of delays in shipments on account of weather conditions.

Sheets

Miscellaneous demand continues fairly active but business from the automotive industry remains slack. Sellers think some more substantial tonnages should be coming from that source shortly if motor car production schedules are to be increased in March. Good specifications are coming from some of the refrigerator manufacturers. Stove manufacturers are maintaining good production schedules and are taking liberal shipments. The $3 a ton concession on black and cold-rolled sheets is quite common, although many of the smaller consumers are paying the regular price. The same concession is being made on galvanized sheets.

Strip Steel

Specifications from automobile parts makers are light and there is very little new business from that source. Leading parts makers continue to operate at considerably reduced schedules and non-integrated cold-rolling plants are ordering little hot-rolled material. Miscellaneous demand is slow.

Iron Ore

The outlook for the iron ore industry for 1936 is quite promising. Stocks at furnaces and docks amounting to 28,404,335 tons on Feb. 1 were 3,622,933 tons lower than on the same date a year ago. During the previous 12-month period ending Feb. 1, 1935, there was a reduction of only about 900,000 tons in stocks. Shipments during 1936 are expected to amount to about 35,000,000 tons as compared with 28,503,501 tons last year, or a gain of 25 per cent.

Bars, Plates and Shapes

Demand for bars from forge shops making automobile parts shows some improvement, although the volume of business is still much below that of a few weeks ago. Bars are also moving better to bolt and nut works that have suffered for several weeks from absence of releases from automotive plants. Small lots are moving fairly well to miscellaneous consumers. The outlook in the construction field is more promising and increased activity is expected with the approach of spring. Inquiries are out for 425 tons for a building and bridge for the Great Lakes Exposition, Cleveland. Ohio highway bridge projects requiring 2500 tons, including 1200 tons for the Black River bridge at Lorain, which is to be readvertised, are expected to be out shortly. A building for the Olds Motor Works, Lansing, Mich., will take 1000 tons. Grade-crossing work in Akron, involving tracks of three railroads, is expected out shortly and will require considerable steel. Reinforcing bars are inactive owing to recent weather conditions. Plates are dull.

Scrap

The market is very firm but inactive. Prices are unchanged. While milder weather probably will bring out an increased volume of scrap brokers do not look for an early weakening of the market as they think that outstanding short orders will sustain prices. Cleveland brokers are paying $15 for No. 1 heavy melting steel against recent purchase at $15.50 by a local mill. For No. 2 steel and compressed sheet steel they are paying $14 and $14.50 respectively. In the Valley district $15.50 is being paid for No. 1 steel for shipments against an order taken a few days ago at $16.

Russia, long famed for entering into large scale enterprises in the most grandiose manner, nonchalantly announces a plan to erect at the Magnitogorsk steel works by Jan. 1, 1938, eight blast furnaces, 23 open-hearth furnaces, two blooming mills and nine rolling mills, with a total capacity of 2,900,000 tons of pig iron, 3,000,000 tons of steel and 2,500,000 tons of rolled steel.

Productimeters

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TELL US WHAT YOU WANT TO COUNT

The National Association of Used Machinery and Equipment Dealers annual meeting was held at the William Penn Hotel, Pittsburgh, Jan. 18, at which time officers and directors were reelected and J. E. Middleton of Philadelphia was appointed secretary. Amendments were adopted providing for individual instead of group membership, and the changing of the time of the annual meeting to September, 1936, and yearly thereafter.

Fabricated Structural Steel

Lettings Lower—New Projects in Good Volume

AMONG awards of 25,950 tons, which compare with 33,215 tons last week, the outstanding bookings are 6000 tons for a city hall in Kansas City, Mo., 3100 tons for the Royton Realty Corpn. in New York, and 2500 tons for a rod mill in Joliet, Ill., for the American Steel & Wire Co. New projects total 21,805 tons as against 13,600 tons in the previous week and 25,350 tons two weeks ago. The largest new jobs reported include 9000 tons for the Middletown-Portland bridge over the Connecticut River in Connecticut, 2000 tons for a State armory in Springfield, Ill., and 1750 tons for the International Harvester Co. at South Chicago, Ill. Plate lettings call for 7650 tons, with 4975 tons pending. Sheet piling awards total 7685 tons. Structural steel awards for the week follow:

NORTH ATLANTIC STATES

Salem, Mass., 520 tons, Hygrade Sylvania Corpn. unit, to New England Structural Co.

Boston, 300 tons, Navy Yard No. 1 pier repairs, to Bethlehem Steel Corpn.

Quincy, Mass., 145 tons, State highway bridge, to Bethlehem Steel Corpn.

New York, 1470 tons, express highway section, West Seventy-ninth to West Eighty-second Streets, to American Bridge Co.

New York, 3100 tons, building for Royton Realty Corpn., to American Bridge Co.

New York, 710 tons, mid-town tunnel ventilator, to Bethlehem Steel Corpn.

New York, 500 tons, Washburn Wire Co. plant addition, to Bethlehem Steel Corpn.

Brooklyn, 1815 tons, public school No. 239, to Bethlehem Steel Corpn.

Brooklyn, 245 tons, Brooklyn Bridge store room, to Ingalls Iron Works Co.

Rochester, 205 tons, State highway bridge, to Genesee Bridge Co.

Woodbury, N. Y., 180 tons, State highway bridge, to Bethlehem Steel Corpn.

Franklinville, N. Y., 195 tons, Pennsylvania grade crossing elimination, to American Bridge Co.

Elmira, N. Y., 150 tons, Sullivan store building, to Genesee Bridge Co.

Erie County, N. Y., 205 tons, State highway bridge, to Fort Pitt Bridge Works Co.

Chemung County, N. Y., 285 tons, State highway bridge, to Fort Pitt Bridge Works Co.

Rome, N. Y., 230 tons, children's building, Rome school, to Belmont Iron Works.

Newark, N. Y., 110 tons, State highway bridge, to Lackawanna Steel Construction Co.

Bergen County, N. J., 115 tons, highway bridge overpass, to American Bridge Co.

Pittsburgh, 285 tons, Fischer Scientific Co. warehouse, to Pittsburgh Bridge & Iron Works.

Homestead, Pa., 255 tons, ramp, Homestead bridge, to American Bridge Co.

Anderson Dam, Pa., 200 tons, dam structure, to Bethlehem Steel Corpn.

Butler, Pa., 120 tons, Montgomery Ward store building, to Bethlehem Steel Corpn.

Baltimore, 230 tons, Young Aniline Works warehouse, to Dietrich Brothers.

SOUTH AND SOUTHWEST

Louisville, Ky., 1000 tons, distillery warehouse, to an unnamed bidder.

Louisville, 260 tons, Clinic hospital building, to Bedford Foundry & Machine Co.

Huntingdon, W. Va., 190 tons, dormitory, to Pittsburgh Bridge & Iron Works.

Texas City, Tex., 200 tons, Standard Oil Co. furnace material, to Ingalls Iron Works Co.

Harris County, Tex., 105 tons, beam spans, to Alamo Iron Works.

Maricopa County, Ariz., 100 tons, State undercrossing near Phoenix, to an unnamed bidder.

CENTRAL STATES

Detroit, 825 tons, grade separation; 500 tons to Jones & Laughlin Steel Corpn. and 325 tons to R. C. Mahon Co.

Highland, Mich., 175 tons, highway bridge, to R. C. Mahon Co.

Ecorse, Mich., 320 tons, Great Lakes Steel Corpn., foot bridge, to Whitehead & Kales Co.

Hammond, Ind., 155 tons, extension to warehouse, an unnamed fabricator.

Waterloo, Iowa, 215 tons, bleachers, to Pittsburgh-Des-Moines Steel Co.

Joliet, Ill., 2500 tons, rod mill for American Steel & Wire Co., to American Bridge Co.

Missouri Pacific Railroad, 190 tons, beam spans, to Missouri Bridge & Iron Co.

Chicago, 195 tons, A. Finkl & Sons forge shop, to Wendnagel & Co.

Kansas City, Mo., 6000 tons, City Hall, to Kansas City Structural Steel Co.

WESTERN STATES

Santa Barbara, Cal., 320 tons, post office, to Bethlehem Steel Corpn.

Los Angeles, 150 tons, tunnel ribs for Metropolitan Water District, Specification No. 53793, to Consolidated Steel Corpn.

Long Beach, Cal., 250 tons, Veterans Memorial hospital, to Pacific Iron & Steel Co.

Los Angeles, 299 tons, Iron Mountain pumping plant, to an unnamed bidder.

Spokane County, Wash., 100 tons, State overhead crossing near Parkwater, to Steel Fabricators, Inc.

Seattle, 100 tons, Fremont overhead crossing, to Pacific Car & Foundry Co.

Ventura County, Cal., 500 tons, Santa Clara River bridge, to Consolidated Steel Corpn.

Seattle, 200 tons, Montgomery Ward building, to Poole & McGonigle.

NEW STRUCTURAL STEEL PROJECTS

NORTH ATLANTIC STATES

Nashua, N. H., 450 tons, high school building.

Middletown-Portland, Conn., 9000 tons, Connecticut River bridge; bids March 9.

Corning, N. Y., 1000 tons, storage building for Corning Glass Works.

Philadelphia, unstated tonnage, two schools; bids March 6.

Tioga County, Pa., 375 tons, highway bridge; bids March 6.

Wilmerding, Pa., 250 tons, high school.

Washington, 400 tons, Capitol Transit Co. bus garage.

THE SOUTH

Dallas, Tex., 400 tons, Ford Motor Co. exhibit building.

Fort Worth, Tex., 900 tons, narcotic farm building.

CENTRAL STATES

Cleveland, 200 tons, bridge for Great Lakes Exposition; bids Feb. 27.

Cleveland, 225 tons, transportation building for Great Lakes exposition; bids March 10.

Cleveland, 400 tons, Ohio Bell Telephone building, general contract awarded to Lundoff-Bicknell Co.

Lansing, Mich., 1000 tons, building for Olds Motor Works.

State of Illinois, 1100 tons, bridges.

Springfield, Ill., 2000 tons, State armory and office building.

South Chicago, Ill., 1750 tons, International Harvester Co. building.

State of Iowa, 425 tons, highway bridges.

State of Wisconsin, 930 tons, 10 highway projects; bids March 6.

Kansas City, Mo., 1645 tons, intercity viaduct; M. E. Gillioz, Monett, Mo., low bidder on general contract.

WESTERN STATES

State of Montana, 325 tons, highway bridges.

Lewis and Clark and Teton Counties, Mont., 159 tons, State bridge on Augusta-Choteau road; bids Feb. 28.

Havre, Mont., 152 tons, State viaduct; bids Feb. 28.

Weld County, Colo., 459 tons, State bridge between Greeley and La Salle; bids March 3.

Montrose County, Colo., 149 tons, State bridge between Montrose and Ouray; bids March 3.

Oakland, Cal., 150 tons, transit shed extension at pier No. 2; bids March 2.

Los Angeles, tonnage unstated, two factory buildings for Federated Metals Co.; bids soon.

FABRICATED PLATES

AWARDS

Pittsburgh, 1200 tons, steel gold-digging dredge for South American delivery, to Treadwell Construction Co., Midland, Pa.

Fort Knox, Ky., 725 tons, tank and tower, to Pittsburgh-Des Moines Steel Co.

Muskegon, Mich., 510 tons, 1,000,000 gal. elevated tank, to Chicago Bridge & Iron Works.

Fort Peck, Mont., 140 tons, ring beam flange plate, to By-Products Steel Corpn., Coatesville, Pa.

San Francisco, 4400 tons, 60-in. pipe line from Crystal Springs to Laguna *Honda reservoir, to Western Pipe & Steel* Co.

South Gate, Cal., 100 tons, elevated tank for city, to Chicago Bridge & Iron Co.

Los Angeles, 425 tons, Iron Mountain pumping plant, to an unnamed bidder.

Los Angeles, 150 tons, 6 and 8-in. welded pipe for Treasury Department, to an unnamed bidder.

NEW PROJECTS

Burlington, Vt., 600 tons, Lake Champlain ferry boats; Gielow, Inc., 25 West Forty-third Street, New York, designer.

Middletown, Conn., 1150 tons, bridge over Connecticut River; bids March 9.

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Milwaukee, 550 tons, lighthouse tender.

Inglewood, Cal., 150 tons, 24-in. welded pipe, Western Pipe & Steel Co. low bidder.

Mare Island, Cal., 175 tons, material for navy yard, Schedule No. 7217; bids opened.

San Francisco, 1362 tons, 25,000 ft. of 36-in. pipe for Treasury Department, Invitation No. 905; bids opened Feb. 26.

Tacoma, Wash., 1375 tons, 8-in. pipe, alternate on lock joint steel cylinder reinforced concrete; bids March 16.

SHEET PILING

AWARDS

Anderson Dam, Pa., 185 tons, piling for dam, to Jones & Laughlin Steel Corpn.

Tennessee Valley Authority, 7400 tons; 4200 tons to Inland Steel Co. and 3200 tons to Bethlehem Steel Corpn.

Seattle, 100 tons, wharf improvement, to Bethlehem Steel Corpn.

NEW PROJECTS

Middletown, Conn., 1260 tons, bridge over Connecticut River; bids March 9.

Railroad Equipment

Lehigh Valley has been granted permission to borrow $1,755,000 from RFC, which, with $327,000 of its own funds, will be used to build and rebuild 1000 coal cars in its shops at Sayre and Packerton, Pa. New material will be used in construction of 250 composite cars, and new and second-hand material will be used in 250 other composite cars and 500 all-steel cars. Railroad states that 1049 of its coal cars *now on hand will soon* be dismantled, 600 more require light repairs and 875 heavy repairs, while an additional 2200 will re*quire heavy repairs within next two years.* Reconstruction Finance Corpn. on Feb. 13 took over activities of the discontinued *Transportation Division of the* Public Works Administration.

***Northern Pacific** is inquiring for* 12 giant locomotives of Mallet 4-6-6-4 type, and 1000 freight cars as mentioned last *week. $4,000,000 will be spent on new* equipment and $338,000 for improvements to track, bridges and terminals.

Missouri Pacific has ordered 300 box cars for its subsidiary, International-Great Northern, from American Car & Foundry Co.

New York, New Haven & Hartford will apply cast steel side frames on 2500 freight cars in place of arch bar side frames.

Milwaukee Road will lease 250 steel sheathed refrigerator cars from Union Refrigerator Transit Co. General American Transportation Corpn. will build the cars.

Reading Co. will air condition 16 passenger cars.

Central of New Jersey will air condition five passenger cars.

American Car & Foundry Motors Co. has received an order from Transit Co. of Harrisburg for five a.c.f. motor coaches, and for 10 from Capital Transit Co.

RAILS AND TRACK SUPPLIES

Missouri Pacific has placed 17,000 tons *of 90 and 112-lb. rails, including 4500 tons* for its Texas subsidiary, International-Great Northern, and about 1,000,000 tie *plates with Bethlehem Steel Corpn., Inland* Steel Co., Carnegie-Illinois Steel Corpn., Tennessee Coal, Iron & Railroad Co. and *Colorado Fuel & Iron Co.*

Western Pacific has placed 10,000 tons of *track fastenings with unnamed bidders.*

***Chicago, Milwaukee, St. Paul & Pacific** has made application to Interstate Commerce Commission for authorization to borrow $3,840,000 from the Reconstruction* Finance Corpn. to aid in financing the purchase of equipment costing $4,800,000. Railroad will supply $960,000 in cash. Equipment to be purchased consists of 1500 freight cars, 37 passenger cars and one passenger locomotive of the Hiawatha-type. Freight cars to be purchased are 500 each of 50-ton hopper coal cars and 50-ton and 40-ton automobile cars. Passenger cars to be bought are 20 air-conditioned coaches, two air-conditioned express and taproom, three air-conditioned parlor, two air-conditioned dining and five mail express and five baggage cars.

Philadelphia Steel Sales Lag; Consumers Await Price Action

Shipyards and Railroads Are Major Market Supports — Autobody Makers' Requirements Should Expand Soon—Scrap Still Strong

PHILADELPHIA, Feb. 25.—With little attractive business currently available here, practically all steel sellers are occasionally resorting to price competition to attract more tonnage in their direction. As pointed out in previous weeks, light cold-rolled sheets are being sold for 3.11c., delivered Philadelphia, with other grades of sheets and strip weaker in sympathy; nails have been sold down to $2.05 a keg, Pittsburgh; orders for small-size pipe are still being taken at levels below published discounts; plates have displayed some weakness even on small orders, and miscellaneous items such as bolts and nuts are unsteady despite any test of the price structure.

These widespread weaknesses are currently of more serious import than is the present lack of consumer demand. There is every probability that steel sales will tend upward during March, but just what price situation will ensue is rather difficult to envision. Most buyers anticipate continued disorganization, but sellers, for the most part, voice the opinion that concessions will disappear in the near future.

Most district mills will close February books with much less new tonnage than the total for January. Nevertheless they continue to maintain open-hearth activity at 40 per cent of capacity. In some cases ingots are being stocked and some finished steel is being rolled in anticipation of late first quarter demands.

Pig Iron

New business has expanded slightly, although total bookings are still considerably under the district consuming rate. Melters continue to draw on their stocks or order against contracts for the major portion of their day-to-day requirements. The stocks and the old contracts should be liquidated by the end of the quarter, after which sales should climb to a level more in line with consumption. When this better business matures, prices will receive a real test, although most furnace representatives are confident that current quotations will hold firmly.

Sheets and Strip

Very little new business is entering the market. Purchases by autobody stamping plants are spotty and small but there is a general expectation of sharply increased orders during the next fortnight. Price concessions on both sheets and strip are available to many buyers. Mills, however, are trying to steady quotations which will apply in the second quarter.

Bars, Plates and Shapes

All construction is still being held up by the weather. The only reinforcing award during the week was 300 tons for a Hershey, Pa., ice rink, awarded to Wrought Iron Co. of America. New projects include about 1000 tons for two Philadelphia schools, on which revised bids are due March 6. Bids go in the same time for the shape requirements for these schools. The only structural award this week was 200 tons for the Anderson Dam in Pennsylvania, to Bethlehem Steel Corpn. Jones & Laughlin Steel Corpn. will supply 185 tons of piling for this same project. Bookings of plates have been very light. New business has been confined to Sun Shipbuilding orders for approximately 5000 tons; about 16,000 tons is yet to be ordered for tankers which this company is to build.

Imports

The following iron and steel imports were received here last week: 2530 tons of chrome ore from British India; 153 tons of sponge iron, 110 tons of steel tubes, 32 tons of steel bars, 21 tons of CD steel wire, 6 tons of steel billets, 3 tons of steel forgings, 2 tons of drill steel from Sweden, and 27 tons of steel bars from Belgium.

Scrap

The weather is clearing somewhat and scrap deliveries are more frequent. The market has lost none of its strength, although prices are still erratic. There has been one moderately large mill order for No. 1 steel at $14.50, but, on the other hand, there has been a direct mill purchase of railroad steel at $12.50. These two prices are exceptional extremes of the market range, and No. 1 steel is accordingly quoted at the same level as last week. Pencoyd is offering $12 for No. 2 steel, and direct mill purchases in Baltimore are being made at $12 and $11 or more for No. 1 and No. 2 respectively. To cover orders at Coatesville, brokers here are openly paying $13.50 for No. 1, and in some cases premiums have been paid. Despite the availability of ready scrap in this area to fill orders, there have been consistent reports that large tonnages are frozen in the Delaware River and will be released as soon as the weather moderates. Although it has been published that 9000 tons is frozen up in this manner, the Maritime Exchange at Philadelphia reports the Delaware open for barges up to Philadelphia. The Maritime Exchange also reports that only one shipment is delayed due to ice, and involves only 700 tons of scrap.

Cast Iron Pipe

Fall River, Mass., has awarded 5700 ft. of 6, 8 and 12-in. to United States Pipe & Foundry Co.

Freeport, N. Y., plans pipe lines for water system and other waterworks installation. Special election will be held March 17 to approve bond issue of $200,000. H. M. Wood is engineer in charge.

Belleville, N. J., has arranged fund of $61,700 through Federal aid and municipal appropriation for 6, 12 and smaller pipe for water system in number of streets.

Evans, N. Y., closes bids March 4 for pipe for water system and other waterworks installation. Cost about $41,400. Nussbaumer & Clarke, Inc., 327 Franklin Street, Buffalo, is consulting engineer.

LaFollette, Tenn., plans pipe lines for water system and other waterworks installation. Bond issue of $130,000 is being arranged.

Morven, N. C., plans pipe lines for water system. Fund of $38,000 has been arranged through Federal aid for this and other waterworks installation.

Mount Pleasant, N. C., will install close to four miles of 6 and 8-in. for water system, recently referred to in these columns; also 100,000-gal. elevated steel tank on 100-ft. tower and other waterworks equipment. Bids will be asked at once. Cost about $87,000. Gilbert C. White Co., Durham, N. C., is consulting engineer.

Rensselaer, Ind., plans about 3600 ft. of 4-in. and smaller quantities of larger size for water system extensions. Charles Brossman, Chamber of Commerce Building, Indianapolis, is consulting engineer.

Keokuk, Iowa, closed bids Feb. 24 on 3000 tons.

Random Lake, Wis., has called special election March 3 to approve pipe lines for water system and other waterworks installation. Financing will be arranged through Federal aid. A. E. McMahon Engineering Co., Menasha, Wis., is consulting engineer.

Mountain View, Mo., plans pipe lines for water system. Cost about $50,000 with other waterworks installation. Beard En-

gineering Co., 44 South Central Street, Clayton, Mo., is consulting engineer.

Axtell, Neb., has approved bond issue for pipe lines for water system and other waterworks installation. Cost about $35,000. Henningson Engineering Co., Union State Bank Building, Omaha, Neb., is consulting engineer.

Plainview, Neb., plans about 3650 ft. of 4-in. for water supply. Financing is being arranged.

Dolores, Colo., plans pipe lines for water system; also other waterworks installation. Special election will be held in April to vote bonds.

Yakima, Wash., has purchased 123 tons of 6 to 18-in. from United States Pipe & Foundry Co.

Palos Verdes, Cal., opens bids Feb. 28 on 450 tons of 1½ to 8-in.

Pipe Lines

Crude Oil Pipe Line Co., San Diego, Tex., plans new welded steel pipe line from local terminus to Corpus Christi, Tex., for crude oil transmission. Large bulk oil storage and distributing terminal will be built at latter point. Entire project will cost about $550,000.

Bureau of Supplies and Accounts, Navy Department, Washington, asks bids until March 10 for 41,500 ft. of welded or seamless steel pipe, galvanized, for Mare Island, Cal., Navy Yard; and for 25,000 ft. of similar pipe for Eastern or Western yards (Schedule 7266).

Lone Star Gas Co., 1915 Wood Street, Dallas, Tex., plans new welded steel pipe line from Long Lake (Anderson County), Tex., to point near Buffalo, Tex., where connection will be made with gas wells of Shell Petroleum Corpn. for natural gas transmission.

Illinois Pipe Line Co., Casper, Wyo., a subsidiary of Ohio Oil Co., same place, with headquarters at Findlay, Ohio, plans new welded steel pipe line from Lance Field, Wyo., oil field district to Fort Bridger, Wyo., where connection will be made with pipe line of Standard Oil Co. of Indiana, Chicago, leading to Freeman, Mo., and vicinity, for crude oil transmission. Cost over $400,000.

Refineries Fuel Supply Co., Crystal, Mich., plans welded steel pipe line from Crystal-Ferris natural gas field, Montcalm County, to point near Alma, Mich., for gas transmission; connection will be made at last-noted place with system of Consumers Power Co., Jackson, Mich., which will distribute at Alma, St. Louis, Breckenridge and Ithaca, replacing present artificial gas service at these points.

Northern Natural Gas Co., Omaha, Neb., has let contract to A. O. Smith Corpn., Milwaukee, for about 100 miles of 20-in. electrically welded steel pipe for new line from natural gas fields at Hugoton, Kan., to point near Mullinville, Kan., where connection will be made with present main pipe line used for natural gas transmission to consuming points in Nebraska and Minnesota. Cost over $1,000,000.

Metropolitan Water District, 306 West Third Street, Los Angeles, requires 1,045,000 lb. of steel pipe in connection with new pumping station in Eagle Mountain district, near Desert Centre, Cal., for Colorado River Aqueduct system, for which bids close March 13 (Specification No. 143). F. E. Weymouth is general manager and chief engineer.

Board of Public Service, St. Louis, has received low bid from Bethlehem Steel Corpn., at $542,880, for 9000 tons of 60-in. welded steel pipe and couplings for conduit from Howard Park pumping station to Stacy Park reservoir.

Seattle will take bids March 10 on 249,595 ft. of 1¼ to 12-in. steel pipe.

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Canadian Steel and Iron Markets Quiet

TORONTO, Ont.—General business conditions in the Canadian iron and steel markets have shown little change during the past week or 10 days. New orders continue in good volume but shipments are disrupted owing to heavy snow and severe winter weather.

Officials of the various steel companies state that there is a steady flow of orders for spot delivery but no large tonnage forward delivery contracts have been placed recently. The automotive industry is furnishing a steady demand for sheets and various other materials. Demand for steel, tools and machinery for mining operations is increasing and a number of good orders have been booked recently with others pending. Agricultural implement makers and sanitary ware plants are increasing operations and taking larger tonnages of raw materials. Building trades are beginning to show minor improvement and there is a growing demand for structural steel in small lots.

Merchant pig iron sales now are said to exceed 1200 tons per week and new buying is increasing. While most melters are taking iron on spot delivery account only and placing orders for lots of 50 to 200 tons, a few have placed forward delivery contracts while others are said to be considering this step for second quarter. Producers are giving prompt delivery on all new orders and demand for iron is running about 50 per cent ahead of that for the corresponding period of 1935. The daily melt is in excess of 50 per cent capacity. Production is holding with four stacks blowing. Prices are firm and unchanged.

While there has been falling off in deliveries of iron and steel scrap owing to bad roads during the past few days, local dealers state that demand and consumption are holding at a good level. Shipments were resumed to the Hamilton district at the close of the week and some good deliveries of heavy melting steel, turnings and other steel grades have been made against contracts.

Westinghouse Electric & Mfg. Co., East Pittsburgh, has issued an unusually attractive Golden Jubilee calendar, 15½ x 33 in., in color, three months on a sheet, with large art illustrations of Boulder Dam water gates, Pennsylvania electric locomotives, Chicago Tribune tower building, flood lighting and other projects using one or more products of the company. The world's largest single shaft turbine generator made by the company is also pictured.

German Steel Exports High—Machinery And Shipbuilding Industries Busier

HAMBURG, Feb. 12 (*By Special Correspondence*).—Orders of German shipyards show a very satisfactory improvement. At the end of 1932 the industry had 88,340 tons of orders in hand; in 1933, 104,760 tons; in 1934, 190,700 tons, and in 1935, 420,000 tons. Germany now ranks second only to Great Britain in shipbuilding activity.

The influx of ship orders from abroad continues. Holland has ordered one tanker of 12,000 tons and a passenger ship of 14,500 tons, and Norway one tanker of 10,000 tons with more pending. The most interesting orders, however, are for 10 heavy sea-going coastal Diesel-engine motor freight boats from Boston, the first order of this kind for service on the New England Coast booked by Burmester Bremen; and an order for 28 high-speed torpedo gliders with only 8-in. draft at full speed when armed with one torpedo, for the Jugoslavian navy. This is the first foreign navy order since 1914. Both the American and the Jugoslavian orders were booked on a barter basis. The American order will be paid by shipment of cotton and copper and the European by pigs, copper and maize.

The German machinery industry reports that business is showing a satisfactory trend. Builders are operating at 73.5 per cent of capacity, compared with 72.6 per cent at the end of 1935 and 64 per cent in January, 1935. Business has been improving steadily since 1933 almost without interruption and without any fluctuations. Export orders, however, which in 1934 had fallen to only 37 to 39 per cent of the total volume and rose to 41 to 42 per cent last year, are now up to 44 to 45 per cent and some branches report even 50 per cent. The machine tool industry is operating at more than 90 per cent, while other branches are less engaged.

Unfilled export orders in the hands of the German steel industry in January were approximately 410,000 tons or 35 per cent above the corresponding time last year. The German steel cartel regards the further outlook for exports as satisfactory.

The menace of Russian competition is again discussed by Continental steel exporters. Russia has sold 160,000 tons of pig iron to Japan on contract for 1936. The price is approximately 18 per cent below the cheapest European offer and 14 per cent below the current Indian sales prices in Japan. Russia has completely outsold India in Japan and the Indian iron industry is therefore expected to seek more business in the United States and the Mediterranean countries.

It is improbable that Russia will sell much steel this year. In October the U.S.S.R. delivered 2000 tons of rails to a Baltic state railroad at a price 19 per cent below IRMA's quotation but 20 per cent of all the rails delivered was returned without payment at the expense of the Russian trust because the quality was unsatisfactory.

Exports of fabricated steel products are also satisfactory. The best results are reported by the rivet and bolt industry which, in 1935, increased exports by 110 per cent. The hinge and lock industry showed an advance of 16 per cent; cutlery, 9 per cent; hand tool and agricultural implement, 38 per cent; sheet hollow ware, 23 per cent; wire, 31 per cent, and small iron goods, 24 per cent. With the exception of cutlery and rivets, the average export sales prices were also increased, which is taken as proof that the higher export movement was not a consequence of price dumping.

Labor Board Rules Against Stamping Plant

HOLDING that the Columbia Enameling & Stamping Co., Terre Haute, Ind., has violated the Wagner-Connery Labor Dispute Act, the National Labor Relations Board has ordered the company to discharge from its employment all production workers who were not employed before a strike of July 22, 1935, and to reinstate "as many as practicable of those who were in the plant before the strike."

The board alleges violation of the act "by pursuing tactics which destroyed a trade union as an effective instrument of employee representation." The union, the board said, is Local 19694 of the Enameling and Stamping Mill Employees Union, "comprising last March, 485 of the plant's 500 production workers but now reduced to ineffectiveness through the company's employment of strike-breakers following a strike at the plant last July."

The board's decision, it announced, "finds that the company did not exhaust the possibilities of collective bargaining to settle that strike; that police and militia were brought in to protect strike-breakers; that picketing was forbidden; and that during the course of these troubles the company refused to recognize the union shop committee with which it had dealings prior to the strike."

Declaring that its aim is to restore, as far as possible, the situation existing prior to the alleged violation of the act, the board said it recognizees that "it would be futile simply to order the company to bargain with the union since the plant now has its full quota of men and the process of bargaining could yield little comfort to those who are not employed." The disputes are said to have centered around the check-off and the closed shop.

Meanwhile, the board has postponed from Feb. 17 until further notice a hearing on a complaint against the Mesta Machine Co., West Homestead, Pa. Charges were filed by the United Roll Turners' Association of America, alleging that the company discriminatorily discharged F. L. Taylor and that it has refused to bargain collectively with the union.

Bridge Competition Announced by A.I.S.C.

FOR its eighth annual student bridge design competition, the American Institute of Steel Construction has selected as a suitable problem the designing of a grade elimination overpass. Students submitting preliminary designs will have them reviewed by the contest judges on April 15. Those responsible for the 10 best entries will then be requested to make finished drawings, which will be judged May 13. The winner will receive a cash prize of $100, while the next in line will be awarded $50. Those receiving the prizes and honorable mentions will be given certificates of award signed by the jury. The jury of nationally know architects and engineers is composed of the following: H. H. Allen, vice-president, J. E. Greiner Co., consulting engineer, Baltimore; Arthur G. Hayden, designing engineer, Westchester County Park Commission, White Plains, N. Y.; Theodore E. Blake, architect, New York; Archibald Manning Brown, president, Architectural League of New York; H. H. Saylor, editor, *Architecture*.

Steel Demand Slightly Heavier at New York

Railroad Buying Subsides in This Area, but Construction Activity Gives More Promise—Connecticut Bridge Will Take 12,000 Tons

NEW YORK, Feb. 25.—Demand for finished steel products seems to be improving slightly in the Metropolitan area, although the price structure is still giving serious concern to selling offices. Weakness in official quotations is even influencing demand to some extent, as buyers are hesitant about placing advance orders in what they regard as a declining market.

In spite of this factor, however, the industry is relatively optimistic about the future. Not only is it generally believed that the price structure will be stabilized in the second quarter, but the opinion also prevails that improved demand for steel will more than offset losses recently incurred in the marking down of contracts.

Railroad buying is less prominent in the New York area this week as most of the tonnage required recently has now been ordered and is being specified. The freight and passenger cars for the New Haven will not likely be placed for some time as the necessary financial arrangements must be made.

A slight let-up in the weather has already influenced steel releases for outside construction work. Considerable inquiry for grade-crossing elimination work is already appearing and apartment building and alteration work in the New York district is rapidly reviving. Most of the projects are small, but represent a fair steel tonnage in the aggregate.

A highway bridge across the Connecticut River at Middletown, Conn., on which bids will be taken March 9, will take 8000 tons of fabricated structural steel, 1000 tons of reinforcing bars, 450 tons of floor steel, 1260 tons of steel piling, 700 tons of plates for caissons and 130 tons of castings.

Pig Iron

Small-lot orders for prompt needs are still in vogue, and tonnage trends show little or no change. Weather obstacles have prevented some foundries from satisfying orders freely, while, in other instances, orders have dwindled because of obstructions further along the line. In any event, foundries themselves have had no incentive to purchase iron other than in limited quantities. There are no indications that second-quarter prices, which go into effect March 1, will be changed. From that period on, however, a better volume of business is looked for. Competition to sell in this district has been intensified by a gradual increase in the available supply, not only due to heavier imports of foreign ores but likewise to the invasion of this field by prominent domestic interests which heretofore have paid little or no attention to the local market.

Reinforcing Steel

Following the placing of the large tonnages involved in the Triborough Bridge, the reinforcing situation has quieted down considerably. Over 6000 tons were awarded on this job, 4000 going to Jones & Laughlin through Tully & Di Napoli, Inc., 1400 tons of trusses to Concrete Steel Co. and 710 tons of bars to Carroll-McCreary Co., Inc. Bids will be taken March 9 on 1000 tons of reinforcing for a bridge over the Connecticut River at Middletown, Conn. No other large jobs are active in this area, but warmer weather is expected to increase highway work and other repair and construction which will involve considerable tonnage.

Scrap

The weather is moderating and supplies are coming out in better volume. Nevertheless, scrap has lost none of its strength here. Brokers are paying $11 for No. 1 for Coatesville delivery, and cast is bringing at least $10 in nearby Jersey for shipment to Harrisburg. Exporters continue to load barges for foreign delivery, and are willing to pay at least $9.25 and $8.25 a ton for No. 1 and No. 2 respectively, delivered alongside

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barge. Inasmuch as additional export sales have been made and domestic demand should be maintained over the next few months, there is every indication that the scrap market here will hold close to present levels for some time. Naturally the eastern Pennsylvania and Pittsburgh markets have exerted some influence on prices here, and a number of grades have advanced for this reason. No. 1 steel has been loaded here for Pittsburgh delivery at approximately $9.75, but the tonnage moving in that direction is not large inasmuch as exporters are diverting most of their supplies to meet foreign demands. Railroad grades, borings and turnings have been loaded here for delivery to both the Philadelphia and Pittsburgh areas, and all these grades are priced on an average of 50c. a ton higher.

Operations Decline in Cincinnati Area

CINCINNATI, Feb. 25.—The adverse effect of weather conditions on automotive production was reflected in this area in the past week by a further decline in sheet mill specifications. During the early part of the week specifications indicated about a 50 per cent demand, but apparent easing in conditions brought better bookings later, so that the average touched 70 per cent of capacity output.

Miscellaneous demand also declined during the week, but this fluctuation was not as pronounced as in the motor car requirements. Despite this decline, district mills foresee a substantial demand in the offing, probably during the early part of March. Operations have been reduced to equal fresh bookings and schedules for this week are set at about 70 per cent of capacity.

Ingot production is off about nine points to 72 per cent as one company took two open-hearths out of production.

The pig iron market is without noticeable feature. Shipments against contract are steadily brisk as melters seek to complete contracts within allotted time. New business is in small lots and is so diversified as to lack indication of definite trend. Foundries are holding their aggregate melt to about 60 per cent of capacity, however, with stove and machine tool melters disclosing the most consistent gains. Specialty foundries are in fair activity, but jobbers indicate slow business.

Movement of foundry coke was moderately heavier in the past week, partly under the stimulus of possible future restriction of shipping facilities. Domestic grades are still in good demand although supplies are reported to be small.

Steel jobbers also blame weather conditions for the falling off in their business during the past fortnight. Up to the middle of the month, the new year improvement had proceeded consistently upward, but this trend has been halted with a possibility that this month may not reach the average January level. Despite this, it is indicated that the current month will average better than the corresponding month of last year.

Conditions favor bullish tendencies in district scrap dealers. Although there has been no appreciable mill buying this year, bids have steadily strengthened. Weather conditions restricting movement of materials, improved bids on recent railroad lists and a close holding of supplies all tend to add substance to dealer optimism.

Auto Employment Being Stabilized

COMPLETE figures on employment and earnings in the automobile industry and the plants supplying automotive parts, during the final quarter of 1935, disclose that the industry's new employment stabilization program succeeded to a remarkable extent in its first stage.

Introduction of new automobile models in November instead of January resulted in more men being at work during fall and early winter than in any previous year, and the high employment trend continued into January. On the basis of this result, the industry already has decided to repeat the program, holding the next annual show on Nov. 11.

The favorable result in automobile factories and parts plants also was obtained to a considerable degree in such industries as steel, glass, rubber, electrical equipment, etc., which depend to a large extent on automobile output, and it is estimated that altogether, including these industries, year-end employment for 150,000 additional persons was brought about by the earlier start on automobile production.

Possibly more important than the increase in number of men employed was the striking rise in payrolls and in individual average earnings.

In the combined automobile and automotive parts industries an average of 453,000 men was employed through the three months, October to December, inclusive. The highest previous mark for the same quarter had been attained in 1928, when an average of 445,000 was reached—a figure never approached from that year until 1935.

Elections Ordered at Pittsburgh Steel Mills

WASHINGTON, Feb. 25.—The National Labor Relations Board has ordered elections by secret ballot to determine representatives for collective bargaining at the Monessen and Allenport, Pa., plants of the Pittsburgh Steel Co. The elections are to be held within 10 days and will be under the direction of Clinton S. Golden, regional director.

The purpose of the elections is to determine whether employees want to be represented by lodges of the Amalgamated Association of Iron, Steel and Tin Workers or by the company-employee representation plan. All Nations Lodge No. 164 represents Amalgamated Association workers at Monessen, while Allenport Lodge No. 160 represents Amalgamated workers at Allenport.

Detroit Scrap Prices Continue to Rise

DETROIT, Feb. 25.—Owing to scarcity of supply, prices continue to soar and it is difficult to gage the market. The rise in steel mill operations and the lull in auto production favor the present trend, but a decline in scrap prices is anticipated in the following week as yard movements increase.

The Carnegie-Illinois Steel Corpn. has approved an appropriation for the construction of a car dumper to replace one which has been in service for 30 years at the Edgar Thomson works, Braddock, Pa. The new dumper will be located on a new site which will fit into the future developments at this plant and will take care of the large and new-type cars now being used. In addition to the modern safety devices which will be part of the car dumper, an up-to-date interlocking signal system will be installed, adding to the safety of its operation.

Zinc Prices Are Advanced $1 a Ton—Copper Tending Toward 9.50c. Level

Sales of Red Metal at Higher Price Still Lacking but Scrap Is Up—Tin Quota Reduced—Lead Stock Increase Small

NEW YORK, Feb. 25.—Domestic copper quotations are still divided, with certain interests holding to 9.50c. a lb., but not securing any business. Sales at the lower level, comprising the market's total turnover, aggregated 1332 tons yesterday, compared with 1067 tons on Feb. 21, the final full day's trading last week. While these figures indicate that the current rate of new business is on a comparatively quiet basis, the market, with respect to higher prices, is possibly a bit stronger, since scrap quotations have advanced consistent with a 9.50c. level. It is a matter of conjecture whether producers who are quoting 9.50c. will be able, or deem it advisable, to outstay the lower-priced competition, but eventually custom melters, after securing enough business, ought logically to be forced to raise prices, inasmuch as they would have to meet the higher figure on scrap purchases. At the moment the scales appear to be tipped in favor of a uniform advance to the 9.50c. basis.

Tin

The International Committee, which met in Paris, Feb. 19, has lowered second-quarter production quotas 5 points to 85 per cent, but the effects of this action on the tin market have been negligible. The reason is that production failed to rise to 85 per cent, even under the preceding quota agreement of 90 per cent. Prior to the committee's action, however, prices worked upward a bit as sales grew heavier, but subsequently a recession has occurred. The price today for spot Straits metal at New York is 47.62½c. a lb., or 0.12½c. under the quotation a week ago. Throughout most of last week business remained very dull, with only an occasional small-lot sale reported. The market today reveals no change in this respect. Latest indications are that the London market is likewise quiet. This morning standard spot gold sold there for £207 10s., while futures were £200 17s. 6d. The Eastern price was £207 7s. 6d.

Lead

January statistics revealed a rise in domestic refined stocks of only 1607 tons, and producers, who expected a less favorable showing, were considerably encouraged. Production dropped from 42,020 tons to 36,296 tons, while shipments decreased from 42,333 tons to 34,590 tons. Stocks at the month's end totaled 224,013 tons. Exceptionally cold weather was the principal factor in keeping production down. Sales in the domestic market last week were reported more active again after a quiet interval.

Zinc

Consumers who were actively shopping around this morning for tonnages at 4.85c. a lb. discovered that their efforts were of no avail, since, effective today, all hands have advanced quotations to 4.90c. Prompted by the likelihood of an impending advance, buyers covered more plentifully last week, and 11,730 tons was purchased. The ability of the market to advance at this time is due, not alone to its statistical strength, but, in a great measure, to support contributed by a higher foreign price for zinc. The question now arises as to whether producers will be content to let matters stand as they are or whether further advances are in store. It is probable that, provided the world price continues firm and spring requirements give domestic consumption a boost, the latter course of action will be attempted. As reported by Prime Western Zinc Producers Committee, January sales of Prime Western totaled 3900 tons for delivery within the month and 7371 tons for forward delivery. Weighted average selling prices, East St. Louis basis, were 4.851c. and 4.837c. a lb. respectively.

Ingot Brass and Bronze

On Feb. 1, unfilled orders for brass and bronze ingots and billets on member books of the Non-Ferrous Ingot Metal Institute totaled 16,119 net tons.

The Week's Prices. Cents Per Pound for Early Delivery

	Feb. 19	Feb. 20	Feb. 21	Feb. 24	Feb. 25
Electrolytic copper, Conn.*	9.25	9.25	9.25	9.25	9.25
Lake copper, N. Y.	9.37½	9.37½	9.37½	9.37½	9.37½
Straits tin, Spot, New York	48.00	48.12½	47.50	47.50	47.62½
Zinc, East St. Louis	4.85	4.85	4.85	4.85	4.90
Zinc, New York†	5.22½	5.22½	5.22½	5.22½	5.27½
Lead, St. Louis	4.35	4.35	4.35	4.35	4.35
Lead, New York	4.50	4.50	4.50	4.50	4.50

*Delivered Connecticut Valley; price ¼c. lower delivered in New York.
†Includes emergency freight charge.

Aluminum, virgin 99 per cent plus, 19.00c.-22.00c. a lb., delivered.
Aluminum, No. 12 remelt, No. 2 standard, in carloads, 17.00c. lb., delivered.
Nickel, electrolytic, 35c. to 36c. a lb. base refinery, in lots of 2 tons or more.
Antimony, Asiatic, 13.25c. a lb., New York.
Quicksilver, $77.50 to $80.00 per flask.
Brass ingots, commercial 85-5-5-5, 9.50c. a lb., delivered; in Middle West ¼c. a lb. is added on orders for less than 40,000 lb.

From New York Warehouse

Delivered Prices, Base per Lb.

Tin, Straits pig	48.75c. to 49.75c.
Tin, bar	50.75c. to 51.75c.
Copper, Lake	10.25c. to 11.25c.
Copper, electrolytic	10.25c. to 11.25c.
Copper, castings	10.00c. to 11.00c.
*Copper sheets, hot-rolled	16.50c.
*High brass sheets	14.62½c.
*Seamless brass tubes	16.87½c.
*Seamless copper tubes	17.00c.
*Brass rods	13.12½c.
Zinc, slabs	5.75c. to 6.75c.
Zinc sheets (No. 9), casks, 1200 lb. and over	10.25c.
Lead, American pig	5.00c. to 6.00c.
Lead, bar	6.00c. to 7.00c.
Lead, sheets, cut	8.25c.
Antimony, Asiatic	14.00c. to 15.00c.
Alum., virgin, 99 per cent, plus	23.30c.
Alum., No. 1 for remelting, 98 to 99 per cent	18.50c. to 20.00c.
Solder, ½ and ½	29.50c. to 30.50c.
Babbitt metal, commercial grades	25.00c. to 60.00c.

*These prices are also for delivery from Chicago and Cleveland warehouses.

From Cleveland Warehouse

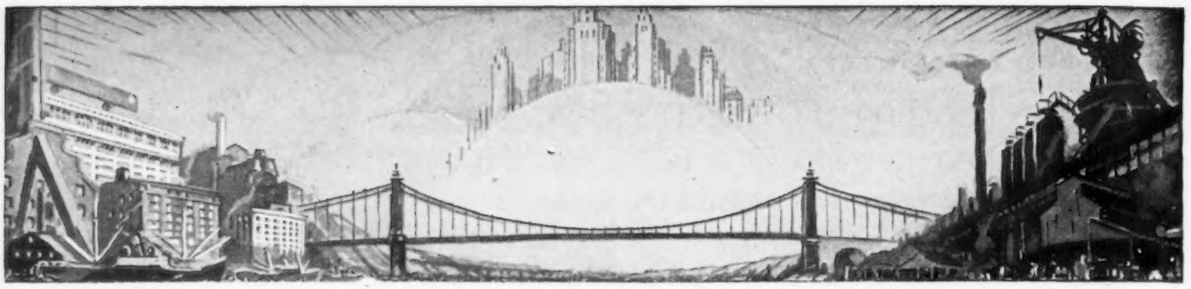
Delivered Prices per Lb.

Tin, Straits pig	52.50c.
Tin, bar	54.50c.
Copper, Lake	10.25c. to 10.50c.
Copper, electrolytic	10.25c. to 10.50c.
Copper, castings	10.00c. to 10.25c.
Zinc, slabs	6.25c. to 6.50c.
Lead, American pig	5.20c. to 6.50c.
Lead, bar	8.50c.
Antimony, Asiatic	17.00c.
Babbitt metal, medium grade	19.25c.
Babbitt metal, high grade	56.50c.
Solder, ½ and ½	29.75c.

Old Metals, Per Lb., New York

Buying prices are paid by dealers for miscellaneous lots from smaller accumulators, and selling prices are those charged to consumers after the metal has been prepared for their uses. (All prices are nominal.)

	Dealers' Buying Prices	Dealers' Selling Prices
Copper, hvy. crucible	7.25c.	8.00c.
Copper, hvy. and wire	7.12½c.	7.62½c.
Copper, light and bottoms	6.12½c.	6.62½c.
Brass, heavy	4.00c.	4.62½c.
Brass, light	3.25c.	4.00c.
Hvy. machine composition	6.00c.	6.50c.
No. 1 yel. brass turnings	5.12½c.	5.62½c.
No. 1 red brass or compos. turnings	5.62½c.	6.12½c.
Lead, heavy	3.50c.	3.87½c.
Zinc	2.50c.	2.87½c.
Cast aluminum	12.12½c.	13.25c.
Sheet aluminum	13.25c.	14.75c.



Plant Expansion and Equipment Buying

Machine Tool Demand Level With Large Orders Lacking

THERE is little if any change in the machine tool situation. Manufacturers are doing a fair business in single tool orders, but no good sized inquiries are pending. The recent price advance on lathes has stimulated the volume of lathe business materially, as buyers were given an opportunity to get under cover before the advances became effective.

A large volume of business in power presses is in prospect from the automotive industry which is now studying its requirements for presses for 1937 models. Important changes in body construction are in prospect, which, if they are made, will necessitate the purchase of a great deal of press equipment.

◀ NORTH ATLANTIC ▶

Ruberoid Co., 500 Fifth Avenue, New York, manufacturer of roofing products, has approved plans for one-story addition to branch plant at Mobile, Ala., where about four acres of adjoining land has been selected. Cost about $200,000 with equipment. Company has acquired former chrysotile asbestos mines of Vermont Asbestos Co., Eden, Vt., comprising about 1700 acre tract in Belvidere Mountain district, Lamoille County, Vt., and will develop for large increased output, with installation of mining equipment, fiberizing and other machinery.

John Eichler Brewing Co., 3582 Third Avenue, Bronx, New York, has let general contract to Hubener & Escher, 748 Melrose Avenue, for three-story addition for storage and distribution. Cost close to $150,000 with loaders, racks and other mechanical-handling equipment. Harley & Ellington, Inc., Stroh Building, Detroit, is architect and engineer.

Signal Supply Officer, Army Base, Brooklyn, asks bids until March 2 for two motor-generator units and two field rheostats (Circular 145); until March 10, 70 resistors, 52 capacitors, 35 transformers, 35 rectifiers, copper terminals, shielded cable, antenna tension springs, grid clips, antenna insulators, plugs, etc. (Circular 139).

New York City Omnibus Corpn., 361 Avenue A, New York, has leased building at 248-52 Bradhurst Avenue for main repair, service and garage for motor buses for transit system, with shops, bulk gasoline storage and distribution and other facilities.

Leviton Mfg. Co., 236 Greenpoint Avenue, Brooklyn, manufacturer of electric wiring devices and equipment, has filed plans for extensions and improvements in four-story plant. Cost over $100,000 with equipment. Gustave Erda is company architect.

Bureau of Supplies and Accounts, Navy Department, Washington, will receive bids until March 3 for motor-driven miller and shaper for Brooklyn Navy Yard (Schedule 7285).

Board of Education, 500 Park Avenue, New York, plans three new vocational and industrial high schools in connection with construction of number of new schools, entire program to cost $25,250,000. A new three-story vocational high school will be located in Williamsburg district, Brooklyn, to replace an existing school now housed in an armory, to cost $1,400,000 with equipment; similar vocational high school will be erected in Northwest section of Queens, cost $1,800,000; and new building for East New York vocational high school, to replace rented quarters, $260,000. William C. Martin, Flatbush Avenue Extension and Concord Street, Brooklyn, is architect and superintendent of schools.

National Can Co., Inc., 110 East Forty-second Street, New York, has begun expansion and improvements in branch plant on Wolfe Street, Baltimore, for which general contract recently was let to Brown & Matthews, Inc., 122 East Forty-second Street, New York. Cost close to $100,000 with equipment.

Quartermaster, West Point, N. Y., asks bids until March 2 for electric starting equipment parts for motor installations (Circular 83).

Empire Metal Creations, Inc., 21 East Twenty-first Street, New York, manufacturer of metal products and novelties, has leased floor in building at 4 West Sixteenth Street for plant.

Commanding Officer, Ordnance Department, Picatinny Arsenal, Dover, N. J., asks bids until March 12 for one special drilling machine, one power press, one planetary thread milling machine, one machine for manufacture of detonator caps and two electric furnaces (Circular 231).

Day-Elder Truck Co., 464 Coit Street, Irvington, N. J., motor trucks, has leased one-story building at 23-27 First Street, Newark, about 15,000 sq. ft. floor space for new assembling and service works. Present plant will be removed to new location. Peter Wendel & Sons, Inc., 171 Badger Avenue, Newark, manufacturer of motor truck bodies and parts, has acquired first noted building in Irvington for new plant and will take possession early in March, removing present factory to that location.

Quartermaster Depot, Twenty-first and Johnson Streets, Philadelphia, asks bids until March 4 for one air compressor (Circular 191).

Philadelphia Metal Window Frame Co., Philadelphia, recently organized, has leased floor in building at Fox and Clearfield Streets for local works.

Commanding Officer, Ordnance Department, Frankford Arsenal, Philadelphia, asks bids until March 4 for two hobs (Circular 344); until March 5, one 5-in. steam chest with valve assembly for turbine unit (Circular 342); until March 9, one automatic turret machine for manufacture of pinion blanks (Circular 329); until March 12, 86,000 outlet sealing cups (Circular 331).

Department of Property and Supplies, Capitol Building, Harrisburg, plans new equipment repair, storage and distributing buildings, with service and garage facilities, for State Highway Department at Allentown, Carlisle, Greensburg, Bedford and New Castle. Bids will be asked early in spring. Cost over $400,000 with equipment.

◀ WESTERN PA. DIST. ▶

Joseph S. Finch & Co., Schenley, Pa., distillers, subsidiary of Schenley Distillers Corpn., New York, has let general contract to Rust Engineering Co., Pittsburgh, for eight-story and basement addition for storage and distribution. Cost over $200,000 with conveying and other mechanical-handling equipment, loaders, etc. Carl J. Kiefer, Schmidt Building, Cincinnati, is company engineer.

Kanawha Valley Power Co., Charleston, W. Va., has secured Federal permission to erect new hydroelectric generating plant at Winfield dam, Kanawha River, near Winfield, W. Va., work to begin early in May. Plant will be connected with present system of company by a steel tower trans-

A typical recuperator installation with air chamber cover removed. "Carbofrax" tubular heat transfer elements are mounted between fireclay terminal walls. Hot waste gases pass around and air through the tube. Note accessibility of tubes for inspection and repair.

Why a Carborundum Recuperator?

...ACCESSIBILITY

Each individual heat transfer element in The Carborundum Co. Recuperator can be easily inspected or replaced without disturbing the rest of the structure . . . The gas passages may be cleaned through suitable access openings in the outside walls—without shutdown . . . Therefore, The Carborundum Co. Recuperator assures—maintenance of production schedules—constant operating conditions—minimum costs for replacement material and labor—maximum investment return . . . Accessibility—one reason why you should consider The Carborundum Co. Recuperator—equipped with "Carbofrax" tubes.

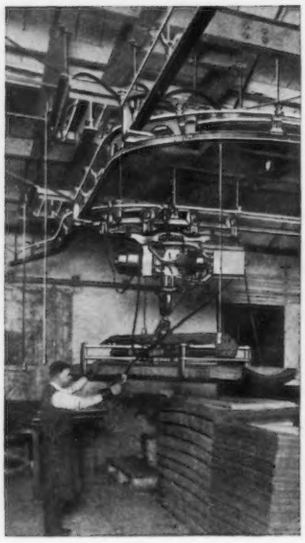
RECUPERATOR
Equipped with "Carbofrax" Tubes

THE CARBORUNDUM COMPANY

Refractory Division, Perth Amboy, N. J.

District Sales Branches: Boston, Chicago, Cleveland, Detroit, Philadelphia, Pittsburgh. Agents: L. F. McConnell, Birmingham, Ala.; Christy Firebrick Company, St. Louis; Harrison & Company, Salt Lake City, Utah; Pacific Abrasive Supply Co., Los Angeles, San Francisco, Seattle; Denver Fireclay Co., El Paso, Texas. (Carborundum and Carbofrax are registered trade-marks of The Carborundum Company)

OVERHEAD MATERIALS HANDLING



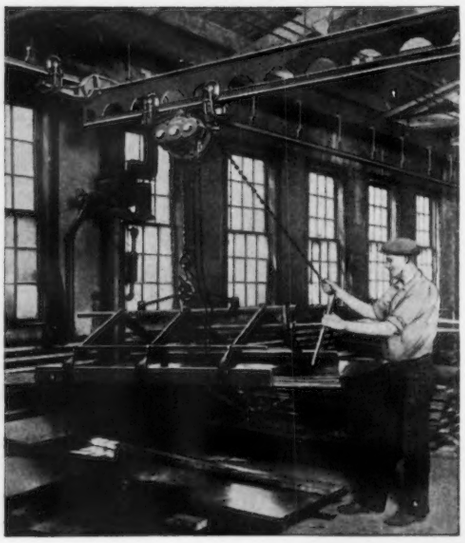


Photo 2110 A

Photo T-2020 B

Photo 2110 A
A hand propelled carrier with floor controlled electric hoist and grab.

Photo T-2020 B
A full hand power system with chain hoist and manually operated grab.

- There are many sheet metal working plants where straight line production has been made possible only by the assistance of Overhead Materials Handling Equipment.
- Cleveland Tramrail is outstanding in the number and types of problems solved in this field. Our experience may help you.
- Full hand power, Full motor operated equipment or Combinations thereof are available.

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CLEVELAND TRAMRAIL

DIVISION OF
THE CLEVELAND CRANE & ENGINEERING CO.
WICKLIFFE OHIO

mission line. Project will include power substations and switching stations, and other operating structures. Cost close to $3,000,000. Company is a unit of American Gas & Electric Co., New York.

Brumbaugh Body Co., 3031 Sixth Avenue, Altoona, Pa., manufacturer of automobile bodies and parts, has acquired industrial buildings and property at Logan Avenue and Plank Road, and will remodel for new works. Cost about $40,000 with equipment.

SOUTH ATLANTIC

J. E. Harris Paint & Varnish Co., 154 Walker Street, S.W., Atlanta, Ga., has let general contract to O. R. Justi Co., Marietta Building, for extensions and improvements in former plant of Fox Mfg. Co., Marietta Street, lately acquired for new works. Cost over $35,000 with equipment.

Savannah Wire Weaving Co., Savannah, Ga., recently organized, has let general contract to Olaf Otto, Savannah, for one-story plant at Port Wentworth, near Savannah, 80 x 80 ft., for manufacture of galvanized steel and copper wire screen cloth and allied specialties. Cost over $25,000 with equipment. Julian E. Howell and Arthur G. Corkery are heads.

Southern Chemical Corpn., Charlotte, N. C., care of John L. Crist, Charlotte, president, formerly southern sales manager for Calco Chemical Co., has plans for new works for manufacture of industrial and textile chemical products, comprising seven one-story buildings, of which six will be equipped for general manufacture. Cost close to $100,000 with equipment. Arthur J. Buchanan will be vice-president, and Leland G. Atkins, plant manager.

NEW ENGLAND

Commanding Officer, Ordnance Department, Springfield Armory, Springfield, Mass., asks bids until March 10 for seven hydraulic table surface grinders, hand cross-feed, 6 x 17 in., and two wet grinder attachments with motor-driven pumps, sediment tanks, shut-off valves, etc. (Circular 131), one single spindle, hydraulic feed vertical drill press, and one multiple drill head with fixed or adjustable centers attachable to drill press (Circular 124); until March 11, one wood-working variety bench saw (Circular 126), two high-speed ball bearing shapers (Circular 125); until March 12, one board matcher (Circular 127).

E. Ingraham Co., North Main Street, Bristol, Conn., manufacturer of clocks, clock mechanisms, etc., has let general contract to Torrington Building Co., Torrington, Conn., for three-story addition, 80 x 160 ft., for manufacture, storage and distribution. Cost over $70,000 with equipment.

Eastern Malleable Co., Naugatuck, Conn., manufacturer of malleable iron castings, etc., will take over at once plant and business of Eberhard Mfg. Co., 2374 Tennyson Road, S. E., Cleveland, manufacturer of kindred products, including hardware specialties, and will operate as a new branch works, supplementing present branch plant at Wilmington, Del. Cleveland plant will be expanded for other lines of production, including vehicle and saddlery hardware specialties, malleable iron parts for trucks and wagons, automotive and industrial wheels, etc. It will be operated as Eberhard Division of parent organization. Lewis A. Dibble is president of Eastern company.

Bureau of Supplies and Accounts, Navy Department, Washington, asks bids until March 3 for one motor-driven steel forming press brake for Boston Navy Yard (Schedule 7265).

Commanding Officer, Ordnance Department, Watertown, Mass., asks bids until March 2 for one vertical milling machine (Circular 384).

SOUTHWEST

Board of Education, Library Building, Kansas City, Mo., George Tinker, secretary, will take bids on general contract early in March for three-story and basement Southeast manual training high school at Meyer Boulevard and Indiana Avenue. Cost about $750,000 with equipment. Wight & Wight, First National Bank Building, are architects; Nate W. Downes, Finance Building, is mechanical engineer.

Crossett Lumber Co., Crossett, Ark., has plans by Hardy S. Ferguson & Co., 200 Fifth Avenue, New York, consulting engineers, for new kraft pulp and paper mill, for which RFC financing in amount of $4,000,000 has been arranged, and will take bids soon through that office on general contract. Plant will consist of several units with capacity of about 150 tons per day. Tract of land has been secured near city limits. A housing development will be carried out for mill employees.

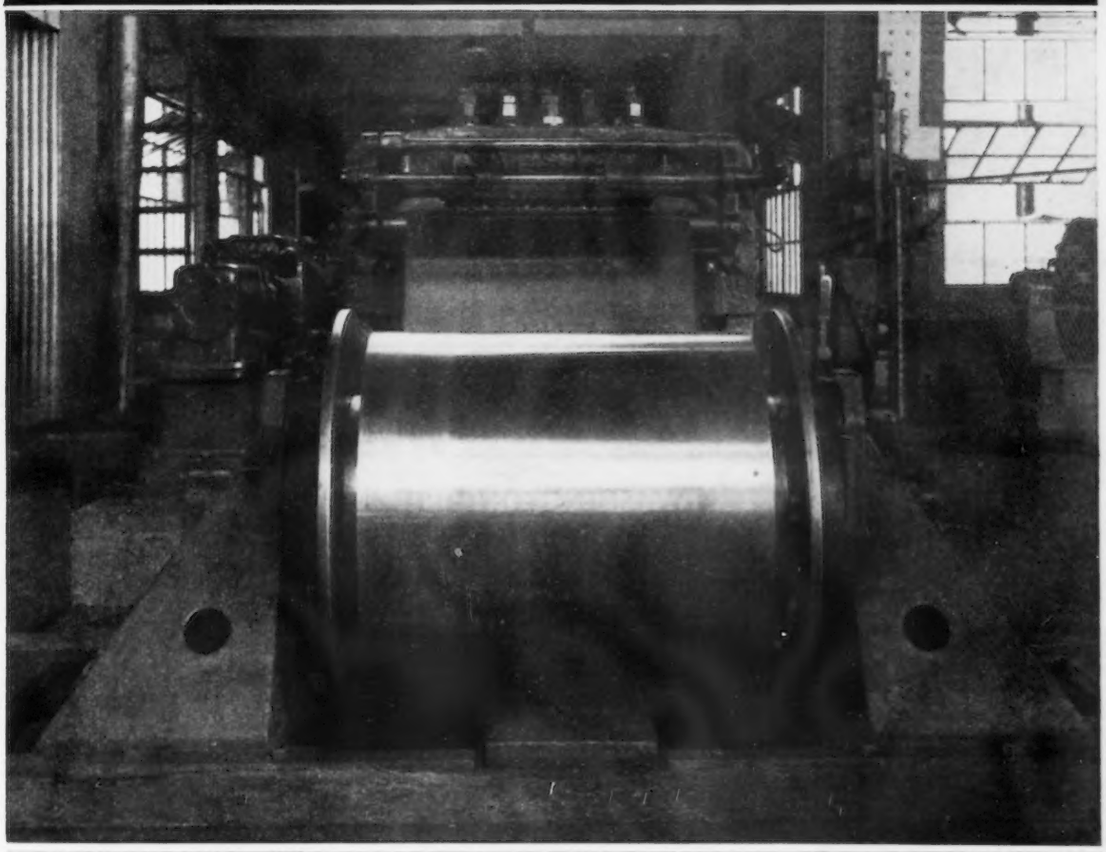
Carondelet Brewing Co., 2025 Gravois Avenue, St. Louis, has approved plans for modernization and expansion in former brewery of Phoenix Brewery Co., 217 South Eighteenth Street, recently acquired. Cost about $165,000 with equipment.

City Council, El Dorado, Ark., plans new municipal electric power plant. Cost about $575,000 with transmission and distributing lines. Financing will be arranged through Federal aid.

State Building Commission, Capitol Building, Jefferson City, Mo., has authorized plans for two new industrial buildings at local State penitentiary, each 150 x 200

MESTA FEED REELS

MOXLEY PATENT



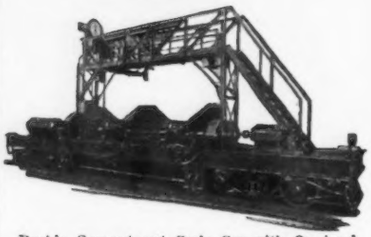
Mesta Feed Reels provide the simplest, most efficient and convenient method of feeding strip from coil to cold mills, continuous pickling equipment, electro-cleaning units, and trimming, levelling, and shearing lines.

Heavy rugged construction of the entire reel permits high speed uncoiling. Motor-operated lift raises coil into position. Simultaneously adjustable heads assure positive centering of the coil.

Reels provided with motor-driven pay-off, if desired.

MESTA MACHINE COMPANY
PITTSBURGH, PA.

ATLAS CARS



Double Compartment Scale Car with Overhead Operator's Platform. Car provided with Orr Bin Gate Operating Mechanism.

20 Ton Capacity Double Compartment Scale Car for use with Orr type Bin Gates controlled from Operator's Station on Scale Car.

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Gas-Electric and Diesel-Electric Locomotives

Electric Transfer Cars for Blast Furnaces and Steel Plants

Stockhouse Scale Cars for Blast Furnaces

Concentrate and Calcine Cars for Copper Refineries

Automatic and Remote Controlled Electric Cars

Pushers, Levellers and Door Extractors

Coal Charging Lorries, Coke Guides and Clay Carriers

Atlas Patented Coke Quenching Cars for By-Product Coke Ovens

Atlas Patented Indicating and Recording Scales

Special Cars and Electrically Operated Cars for every conceivable purpose.

THE ATLAS CAR & MFG. CO.

Engineers - Manufacturers

1140 Ivanhoe Rd., Cleveland, O

ft. Cost about $200,000 with equipment. Alonzo H. Genery, Voskamp & Neville, Inc., 4 West Thirteenth Street, Kansas City, Mo., is architect; Charles A. Haskins, Finance Building, Kansas City, is supervising engineer.

Champion Paper & Fibre Co., Hamilton, Ohio, manufacturer of paperboard and other paper products, has let general contract to Morton C. Tuttle Co., 31 St. James Avenue, Boston, for new multi-unit pulp mill on 160 acre tract on Houston ship channel, near Houston, Tex., recently acquired. Plant will operate under a new process for production of sulphite pulp from Southern slash pine. Erection is scheduled to begin early in April. Cost about $3,000,000, of which about $550,000 will be used for buildings and $2,000,000 for machinery. Financing has been arranged through new stock issue. Reuben B. Robertson is executive vice-president.

BUFFALO DISTRICT

Bell Aircraft Corpn., 2500 Elmwood Avenue, Buffalo, manufacturer of airplanes and parts, has leased about 80,000 sq. ft. in adjoining plant units, formerly occupied by Consolidated Aircraft Corpn., for expansion, primarily for airplane parts, wing panels, etc. This makes a total of 124,000 sq. ft., for works established last fall, or about one-half of former total floor area of Consolidated company. New machine tools and other equipment will be installed soon. Major Lawrence D. Bell is president.

Continental Can Co., Inc., East Water Street, Syracuse, N. Y., with headquarters in New York, has approved plans for two story addition, 100 x 230 ft., to warehouse at first noted place, and one-story top addition to present unit. Cost close to $100,000 with equipment.

WASHINGTON DIST.

Peters Auto Body & Spring Works, Inc., Ensor and East Streets, Baltimore, has asked bids on general contract for one-story addition. Cost close to $30,000 with equipment.

Commanding Officer, Ordnance Department, Aberdeen Proving Ground, Aberdeen, Md., asks bids until March 2 for one pressure gage or scale (Circular 82); until March 6, one underfeed stoker (Circular 87).

Board of District Commissioners, District Building, Washington, asks bids until March 2 for motor truck parts for city refuse division.

City Council, Luray, Va., plans municipal electric power plant. Cost over $150,000. Financing will be arranged through Federal aid. Schofield Engineering Co., Commercial Trust Building, Philadelphia, is consulting engineer.

General Purchasing Officer, Panama Canal, Washington, asks bids until March 10 for machine bolts, stud bolts, hexagonal nuts, brass cotter pins, bolts, nuts and washers, steel chains, steel shackles, shackle pins and washers, cast bronze pin bushings, rolled nickel-steel yoke pins, mild steel stud bolts, mild steel packing bolts, galvanized steel machine bolts, sleeve nuts, cast iron separators, brass pipe and other supplies (Schedule 3126).

Chemical Warfare Service, Edgewood Arsenal, Md., asks bids until March 2 for cadmium coated music-wire springs (Circular 52).

Steel & Tin Products Co., 2100 Aliceanna Street, Baltimore, manufacturer of metal novelties, has acquired building at 239-47 President Street for expansion.

Bureau of Supplies and Accounts, Navy Department, Washington, asks bids until March 3 for one motor-driven metal-forming machine for Norfolk Navy Yard (Schedule 7280); seamless copper tubing (Schedule 7254), motor-driven boiler tube cleaning outfits (Schedule 7241), motor-generator set, tanks, blower, recorder-controller, etc., for electroplating (Schedule 7193), flexible metallic fuel oil hose (Schedule 7230), air-driven boiler tube cleaning outfits and wrenches (Schedule 7233); until March 6, one motor-driven vertical shaper (Schedule 7251), composition valves (Schedule 7269), 30 chains, complete with flights, and 32 sprockets (Schedule 7200) for Eastern and Western yards; motor-generator set for Washington yard (Schedule 7256).

SOUTH CENTRAL

Director of Purchases, Tennessee Valley Authority, Knoxville, Tenn., asks bids until March 13 for 298 single-circuit steel transmission towers.

Kentucky Independent Packing Co., Lexington, Ky., meat packer, has let general contract to Savage Lumber & Mfg. Co., Lexington, for remodeling former meat-packing plant of Munn Brothers Co., Old Frankfort Pike, and erection of two-story addition. Property noted was recently acquired for new plant. Cost close to $100,000 with equipment.

Owensboro Grain Co., Owensboro, Ky., plans rebuilding of portion of grain elevator recently destroyed by fire. Loss about $75,000 with elevating conveying and other mechanical equipment.

Sewage and Water Board, 526 Carondelet Street, New Orleans, asks bids until April 2 for motor-driven pumping machinery and accessories, switchboards, transformers and other electrical equipment, underground conduits and power cable, and miscellaneous equipment for new municipal sewage disposal works. Alfred F. Theard is general superintendent.

Mississippi River Commission, United States Army, Vicksburg, Miss., asks bids until March 3 for one centrifugal pumping unit with accessories (Circular 17).

OHIO AND INDIANA

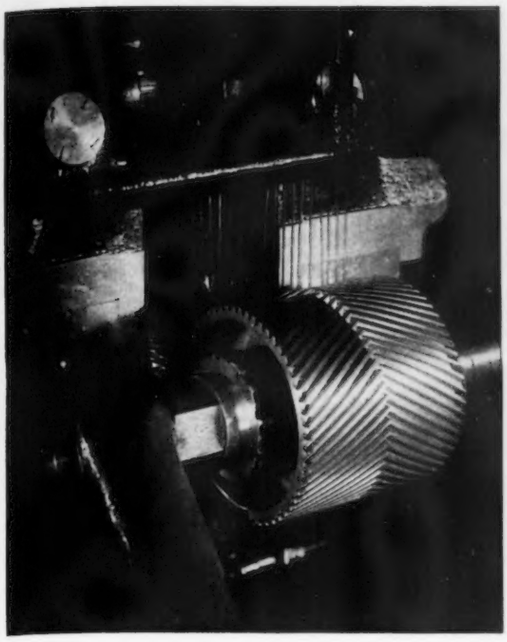
Doehler Die Casting Co., 2100 Smead Avenue, Toledo, Ohio, plans one-story addition, for which bids will be asked on general contract early in spring. Cost over $225,000 with equipment. Company will also carry out expansion and improvements in branch plant at Pottstown, Pa., including new equipment. Cost about $175,000 with equipment.

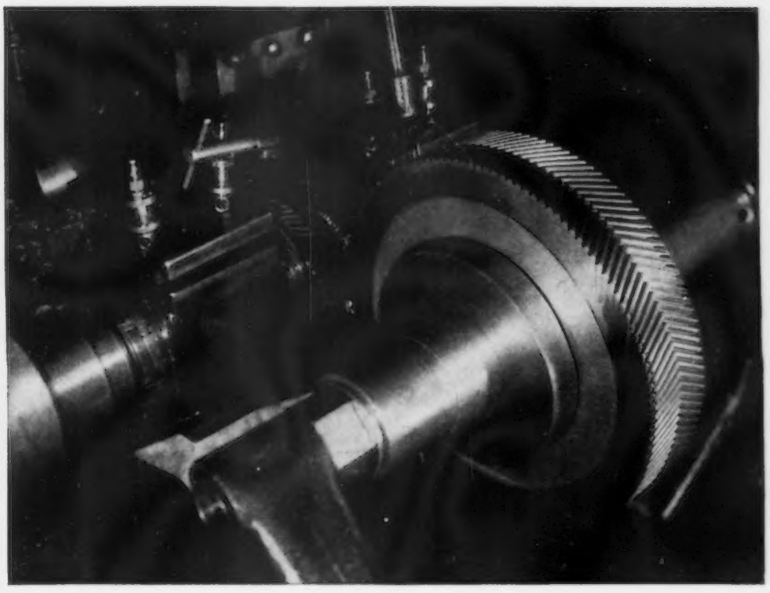
Quartermaster Supply Officer, Columbus General Depot, Columbus, Ohio, asks bids until March 17 for four portable electric stacking machine conveyor units, four portable electric elevators, 42 gravity conveyors and 45 portable stands for such conveyors, six dollies, four hand-lift trucks, 20 skid platforms, one electric low-lift truck tractor, one three-wheel and one four-wheel electric industrial tractor, one telescopic type electric tiering truck, 200 four-wheel warehouse trucks and 50 two-wheel warehouse trucks (Circular 2).

Beckett Paper Co., Hamilton, Ohio, has rejected bids recently received for new power plant, and will ask new bids soon. Installation will include high-pressure boiler unit and auxiliary equipment. Cost over $200,000. Fosdick & Hilmer, Union Trust Building, Cincinnati, are consulting engineers.

Contracting Officer, Material Division, Air Corps, Wright Field, Dayton, Ohio, asks bids until March 2 for three motor-driven precision bench lathes (Circular 569), two portable masts (Circular 564); until March 3, 20 portable electric saws (Circular 577), nine buffers and polishers, 28 grinders and buffers, 31 pedestal-type grinders, seven bench-type grinders, 24 portable grinders, and five tool post grinders, all motor driven (Circular 559); until March 4, two drafting machines, two drawing tables and four-plan file units (Circular 571), interchangeable pilot counterbores (Circular 578), one spring coupling testing machine (Circular 574); until March 5, cleaning and plating equipment (Circular 583), five gear-driven pumps (Circular 597), one trainer, complete with instruments and automatic course recorder (Circular 582); until March 6, two diamond tools, wheel and tail stock wrench, motor-driven valve facing attachment, and one motor-driven grinder (Circular 589), two hand-operated sheet metal brakes, nine motor-driven sheet metal machines, one slip roll former, three hand-operated scroll shears, one hand-operated bar shear, two slitting rotary shears, three foot-power squaring shears, four motor-driven squaring shears, one motor-driven sheet metal nibbler, three motor-driven slip roll formers, and three hand-operated brake and folder (Circular 572).

Contracting Officer, Quartermaster Corps, Jeffersonville, Ind., asks bids until March





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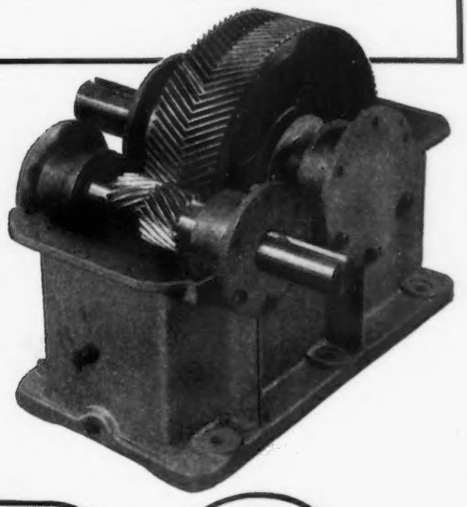
GEARS GO AROUND AND AROUND

DURABILITY, an inbuilt quality in all types of James speed reducing units, is fully developed in James generated continuous-tooth herringbone types, every effort being made to maintain our reputation as originators and builders of highly-efficient, speed-reducing equipment to suit every condition of drive.



The James continuous-tooth herringbone gears permit a greater number of teeth in contact at one time which produces a continuous, noiseless action and will withstand the maximum of load and shocks. Our large battery of Sykes generators enables us to offer you the utmost in continuous-tooth herringbone gears.

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TEST THIS WELDING TORCH FREE FOR TWO WEEKS IN YOUR PLANT

3 for 20,000 bolts and mess stool parts (Circular 200); until March 10, 1200 steel shells (Circular 194).

Board of Public Works, Portland, Ind., will make extensions and improvements in municipal electric power plant, including new equipment. Cost about $175,000. Bevington-Williams, Inc., Indiana Pythian Building, Indianapolis, is consulting engineer.

Clark Controller Co., Cleveland, will enlarge its engineering and research department by erection of an extension providing 6000 sq. ft. additional floor space.

Albra Castings Corpn., Huntington, Ind., has opened a new foundry specially equipped for production of aluminum, brass, monel and other non-ferrous castings. Company was recently organized with Herman Voges, Jr., president; V. W. Pacula, vice-president; S. R. Richey, secretary, and Charles H. Terrel, treasurer.

MICHIGAN DISTRICT

Saginaw Steering Gear Co., Saginaw, Mich., has plans for one-story addition, primarily for storage and distribution. Cost close to $30,000 with equipment.

A. J. Brandt, Inc., 7300 Woodward Avenue, Detroit, engineer, has taken an option to purchase plant and business of former Franklin Automobile Co., Syracuse, N. Y., and contemplates resuming operations for manufacture of automobiles and parts. A. J. Brandt, head, was formerly identified with American Austin Motor Co. and Hupp Motor Co.

Sewell Cushion Wheel Co., 4091 Beaufait Avenue, Detroit, manufacturer of automobile wheels, etc., plans rebuilding part of storage and distributing plant recently destroyed by fire. Loss over $65,000 with equipment.

Detroit Lubricator Co., 5842 Trumbull Street, Detroit, manufacturer of lubricators and parts, pumps, valves, etc., has plans for one-story addition and improvements in present plant. Cost over $35,000 with equipment. Robert O. Derrick, Inc., Union Guarantee Building, is architect.

Star Steel Supply Co., 7522 Oakland Street, Detroit, iron and steel products, has let general contract to O. W. Burke Co., Fisher Building, for one-story addition for storage and distribution. Cost close to $40,000 with equipment.

Board of Education, South Haven, Mich., will soon take bids on general contract for new two-story vocational school. Cost over $75,000 with equipment. M. C. Billingham, Kalamazoo, Mich., is architect.

MIDDLE WEST

Pure Oil Co., 35 East Wacker Drive, Chicago, plans extensions and improvements in refinery near Nederland, Tex., including additional equipment. Cost over $600,000 with machinery. R. L. Vernor is superintendent of refineries, first noted address.

L. A. Young Spring & Wire Corpn., 53 West Jackson Boulevard, Chicago, has acquired tract adjoining local plant on South Oak Park Avenue, Clearing Industrial District, 134 x 190 ft., for one-story addition, work to begin in spring. Cost over $60,000 with equipment. Company headquarters are at 9200 Russell Street, Detroit.

Public Utility Board, City Hall, Rochester, Minn., A. J. Lentfer, secretary, will take bids early in spring for equipment for expansion in municipal electric light and power plant, including 7500-kw. turbogenerator, with alternate bids on a 10,000-kw. unit, with auxiliary equipment. Cost about $200,000. Burlingame & Hitchcock, Sexton Building, Minneapolis, are consulting engineers.

Grand Forks Terminal Elevator Co., Grand Forks, N. D., care of Thomas Berge, 729 Reeves Street, president, recently organized, plans new grain elevator with initial capacity of 500,000 bu. Cost close to $125,000 with elevating, conveying, screening and other mechanical equipment. Financing is being arranged.

Board of Regents, University of Minnesota, Administration Building, Minneapolis, has approved plans for two-story hydraulic laboratory, 50 x 300 ft., for engineering college, with adjoining one-story machine experimental building, 50 x 90 ft. Fund of $100,000 has been secured through Federal aid. Dr. Lorenz Straub, Engineering College, University Campus, will be in charge.

Swift & Co., Union Stock Yards, Chicago, plan rebuilding gas-generating station recently destroyed by fire, caused by an explosion. Loss over $90,000 with equipment.

Farm Electric Service Co., Aitkin, Minn., subsidiary of Rural Utilities Co., same place, plans about 100 miles of transmission and distributing lines in different parts of Aitkin County for rural electrification, with power substation and service facilities. Cost $100,000. Financing has been completed through Federal aid.

Trane Co., La Crosse, Wis., manufacturer of steam and vapor heating equipment, has started work on addition, 120 x 163 ft., to factory No. 2 at Sixteenth and Bennett Streets, for production of air-conditioning apparatus. Investment in building and equipment is estimated at $60,000. Reuben N. Trane is president and general manager.

PACIFIC COAST

Douglas Aircraft Co., 3000 Ocean Park Boulevard, Santa Monica, Cal., has authorized plans for another plant addition, supplementing extension recently noted in these columns, to be one story and basement, 300 x 300 ft. Cost over $250,000 with equipment. Edward C. Taylor and Ellis W. Taylor, 803 West Third Street, Los Angeles, are architects and engineers.

Bureau of Reclamation, Denver, asks bids until March 16 for one vertical shaft 11,500-hp. hydraulic turbine for hydroelectric generating plant at Morman Flat, Ariz., Salt River project, with alternates for a new plate-steel scroll case, speed ring, and draft tube liner for present unit of same capacity now installed at station; and for one 102-in. diameter butterfly valve with operating mechanism (Specification 671).

Union Die-Casting Co., 2269 East Fifty-first Street, Vernon, Los Angeles, has let general contract to Ryan A. Grut, 318 West Ninth Street, for new one-story plant, 76 x 82 ft. Cost over $30,000 with equipment. Hugo Eckart, 3345 South San Gabriel Boulevard, San Gabriel, Cal., is engineer.

Fred J. Rogers, 1504 Textile Tower Building, Seattle, architect and engineer, has plans for a new one-story fish-canning and processing plant, 160 x 240 ft., on waterfront, for company whose name is temporarily withheld. Wharf will also be built. Entire project will cost about $150,000 with machinery. George N. Barker & Associates, Textile Tower Building, are electrical engineers.

United States Engineer Office, Sacramento, Cal., asks bids until March 10 for one Diesel-powered track-laying type tractor (Circular 172).

Pomona Pump Co., Palomares Street, Pomona, Cal., has let general contract to Stover Brothers, Claremont, Cal., for new one-story plant, 70 x 120 ft. Cost close to $30,000 with equipment. Peter Ficker, Pomona, is architect.

Bureau of Supplies and Accounts, Navy Department, Washington, asks bids until March 6 for 15 electric grinders (Schedule 7237), 5000 ft. arc welding insulated electric cable (Schedule 7249); until March 10, two double-drum winches and spare parts (Schedule 7268) for Mare Island Navy Yard; one motor-driven pedestal grinder for Puget Sound Navy Yard (Schedule 7262).

FOREIGN

Southern Railroad, Ltd., London England, is planning extensions in electrified lines, including construction of overhead steel structures, feeder and distributing lines, power substation and booster stations and other facilities. Fund of £6,000,000 ($30,000,000) is being secured through Government aid for entire project. Work will include a number of suburban branch lines.

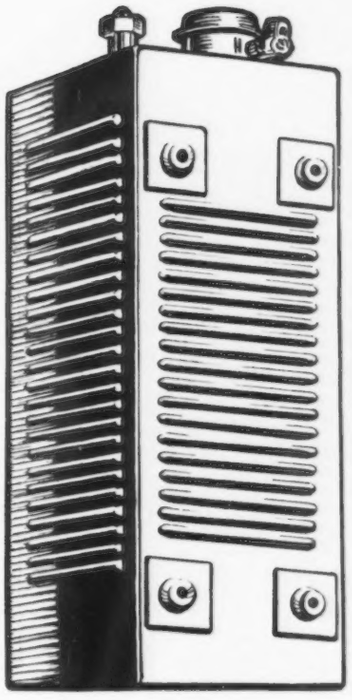
North British Rayon Co., Ltd., Tedburgh, Scotland, plans new works in Murray Green district, to include power house, machine shop and other structures. Cost over $1,000,000 with equipment.

City Electric Light Co., Ltd., Brisbane, Australia, asks bids until April 17 for electric transformers, pole type boosters, and auxiliary equipment (Specifications 212); until April 24, for 33,000-volt electric cable (Specifications 211).

STEEL BATTERIES DOMINATE IN THE STEEL INDUSTRY

Materials handling must flow without interruption... so more industrial trucks are powered by Edison Steel Alkaline Batteries than by all other makes combined. (Steel batteries are not subject to unexpected failure, therefore are economical insurance against production tie-ups.) . . .

But as you would expect, the predominance of steel batteries in the steel industry is even greater. 71% are Edison.



This is to be expected for two reasons: First, the conditions surrounding steel production are such that only an exceptionally rugged, non-temperamental battery of the steel-alkaline type can economically fulfill the requirements. Second, steel companies are quick to recognize that steel batteries again dramatically re-emphasize the suitability of steel in construction requiring strength, dependability and long life.

PARTIAL LIST* OF PROMINENT STEEL COMPANIES USING EDISON BATTERIES

Allegheny Steel Company • The American Rolling Mill Company • Crucible Steel Company of America • Gulf States Steel Company • Oliver Iron and Steel Corp. The Otis Steel Company • Pittsburgh Steel Company John A. Roebling's Sons Company • Sharon Steel Hoop Company • American Sheet and Tin Plate Company Carnegie-Illinois Steel Corp. • Wickwire Spencer Steel Company • The Youngstown Sheet & Tube Company.

**In addition, are several prominent steel corporations whose names do not appear here.*

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Overhead Traveling Cranes
1 TO 450 TONS CAPACITY

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MOST COMPREHENSIVE LINE OF CRANES & HOISTS

Correlation Between Metallography and Mechanical Testing

(CONCLUDED FROM PAGE 29)

plastic action in easing overstress, and thus preventing spreading cracks is probably the salvation of many a crank pin and railroad rail. Professor Seely recently uttered a striking epigram, "The reason why we can use the theory of elasticity for designing actual structures and machines is that our actual materials are not perfectly elastic."

Yet another field in which correlation of metallographic and mechanical methods is needed is the study of the relative seriousness of "inherent" and "imposed" sources of stress concentration — "stress raisers," as Gillett has aptly called them. The speaker uses the term "inherent" to denote stress raisers existing in the structure of a metal, i.e., shatter cracks, non-metallic inclusions, dendritic crystals, slag streaks, etc. The term "imposed" is used to denote stress raisers caused in machining, rolling, or casting the metal, i.e., such things as screw threads, notches, sharp shoulders, etc. So far the meager data indicate that stress raisers which are outright discontinuities in structure, such as shatter cracks in railroad rails or sharp notches in machine parts, seem to be much more serious than are stress raisers which do not cause discontinuity of structure, such as slag streaks, large or irregular crystals, etc. (Graphite flakes in cast iron act like discontinuities. Gray cast iron may be regarded as iron containing many cracks filled with a lubricant.)

However, there is the disconcerting result of some tests which seem to show that even discontinuities like shatter cracks do not cause as much weakening of structure as would appear from the formulas of the theory of elasticity. The good-natured ductility of metal around these discontinuities does its best to ease the localized stress and distribute it over a larger area, but there is a limit to this good-natured ductility, and then spreading fracture starts.

Surely further study of the relative seriousness of various types of metallographic imperfections of structures and of mechanical imperfections of form, forms a fertile field for joint study by metallurgists and testing engineers.

Microscopic Study of Ancient Bronze and Copper

(CONCLUDED FROM PAGE 37)

The series of experiments and observations by the authors, therefore, resulted in the four general conclusions which follow.

(1) In general, the structural peculiarities of ancient bronze and copper are all readily attributable to the crude methods of smelting and treating the metals in the early days of civilization. It is to be noted, however, that the difference between the old and the modern metals is not always very pronounced. There are some examples of ancient metal objects that are almost free from the usual impurities and their structure is normal in every respect.

(2) There is no sign of change in or disintegration of the solid solutions or other components of the metal, except that due to corrosion; this applies even to specimens 5000 or 6000 years old.

(3) Microstructural features of initial corrosion and of patina rather than structure of metal give the most reliable proof of the ancient origin of the metal.

(4) The investigations have disclosed characteristic differences in the initial corrosion of the many specimens of widely different origin or location examined. According to variations in the selective action and in the path of corrosion, six typical cases or distinct types of corrosion of copper and bronze were revealed (this is not covered in this abstract).